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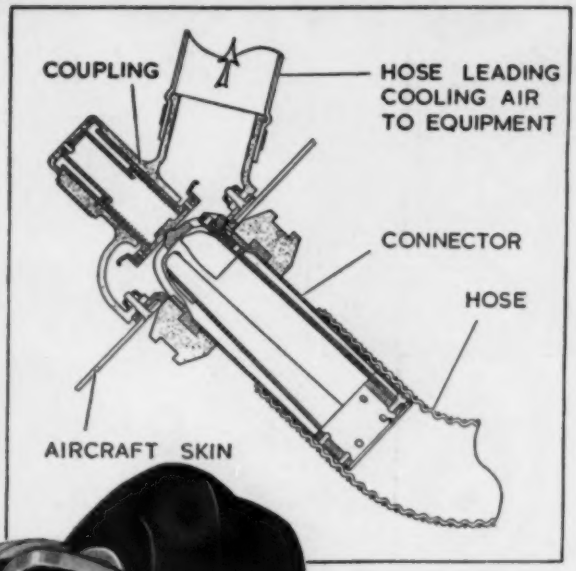

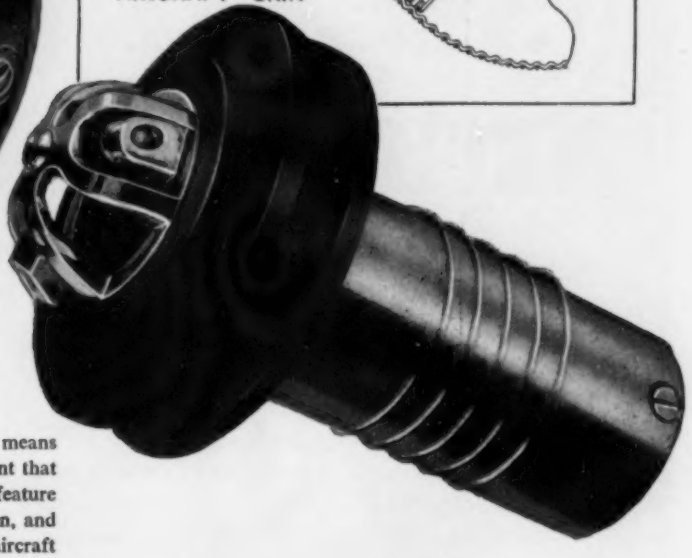

This coupling and its associated connector provide a means of passing cooling air to any particular items of equipment that can overheat during ground-running. The important feature in the design is that the connector can be left in position, and the cooling flow maintained, right up to the moment the aircraft moves away for take off.

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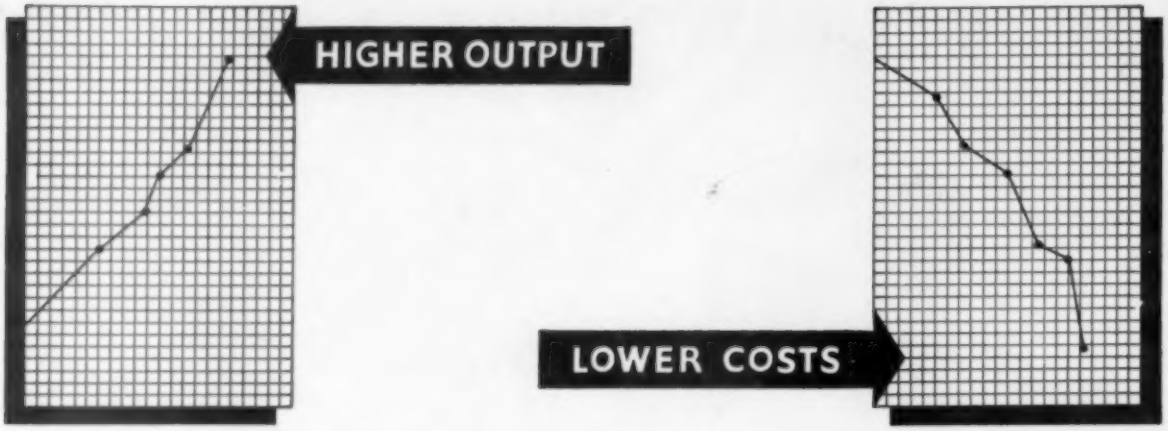

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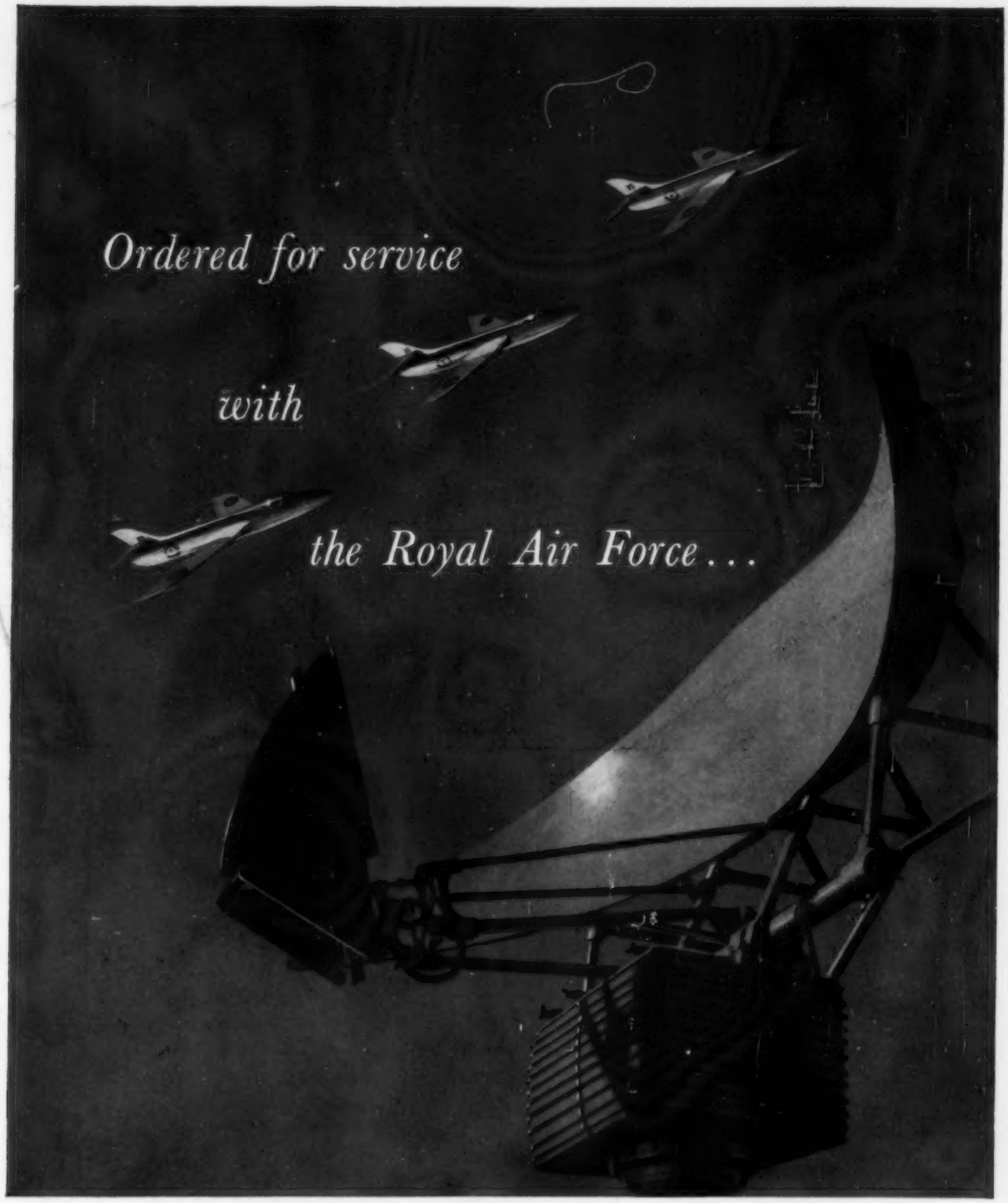

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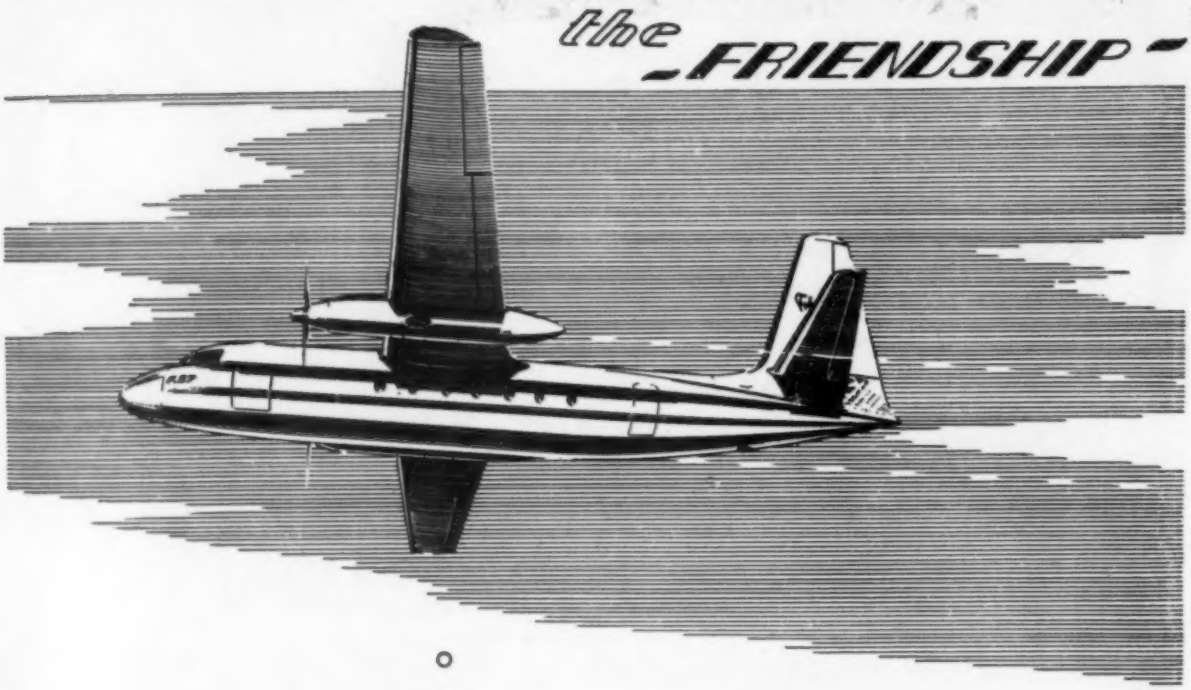

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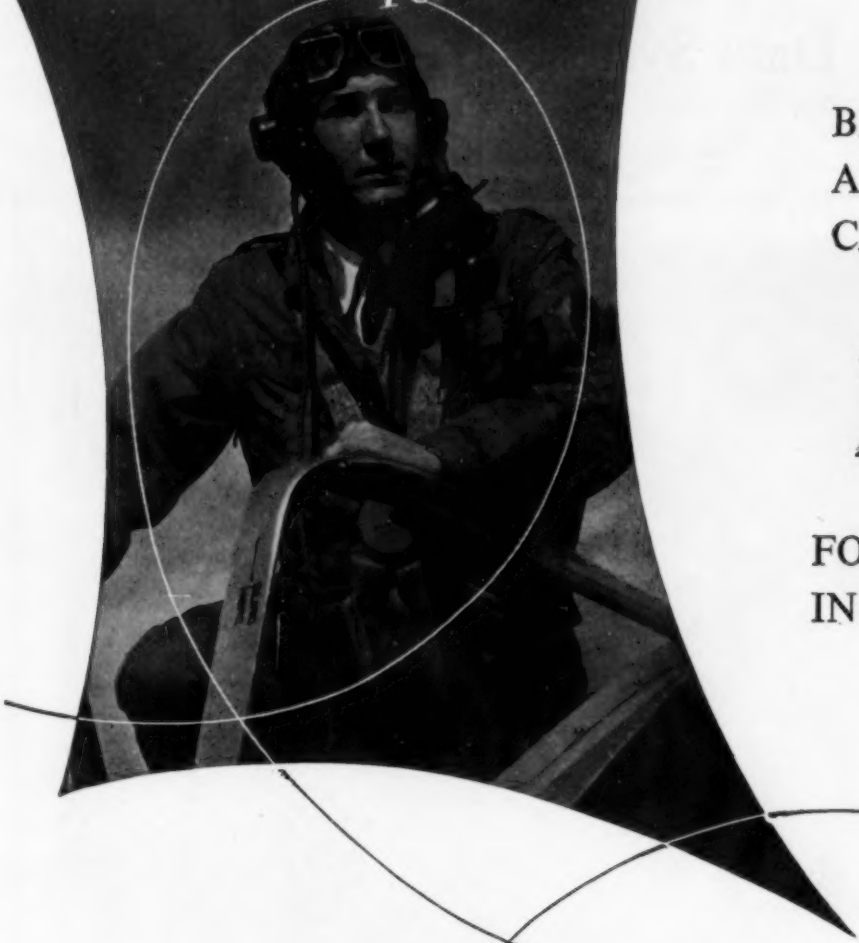

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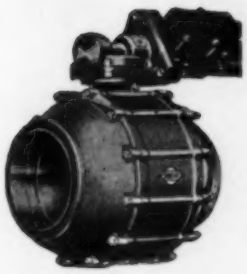

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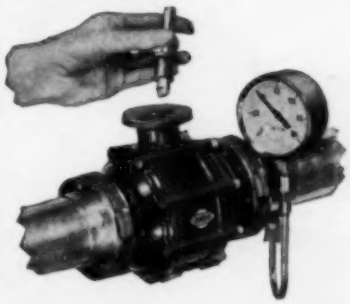

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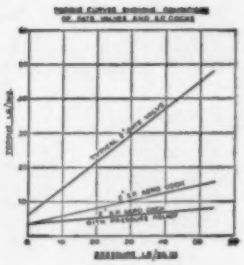

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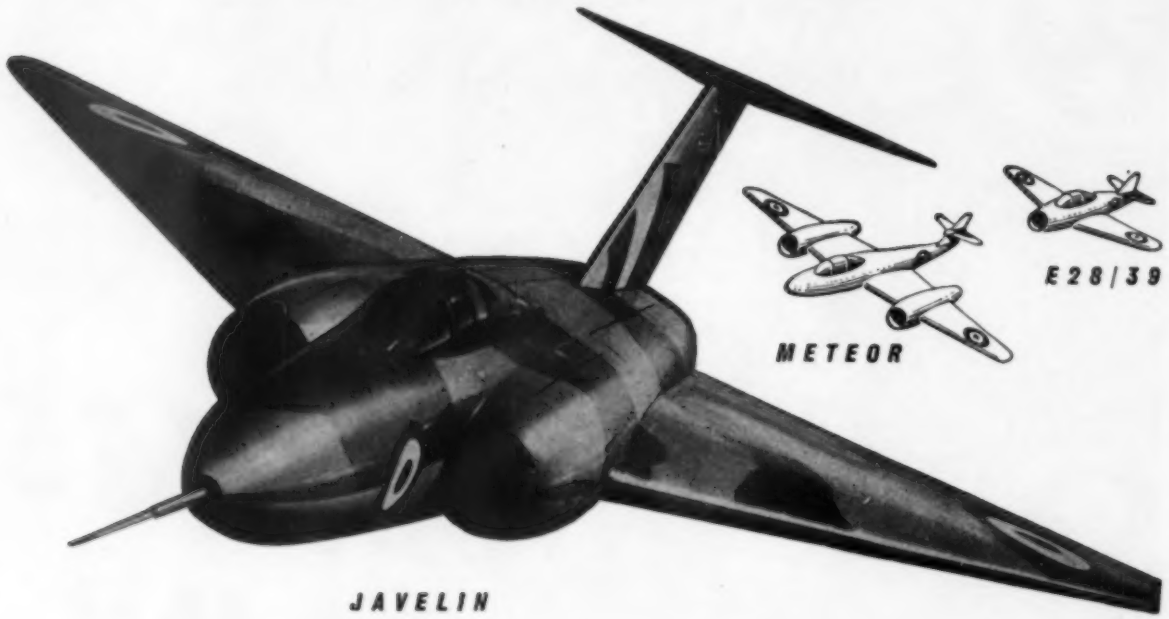

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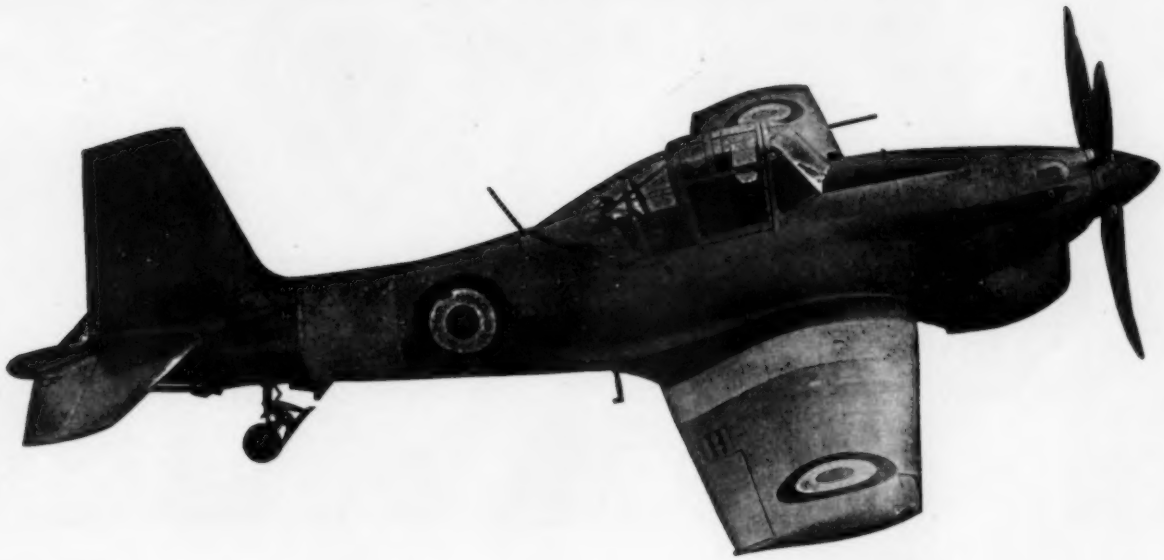

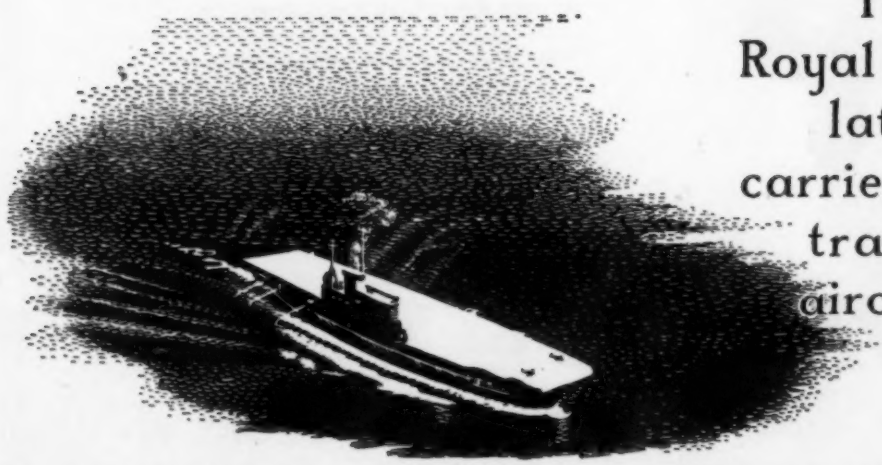

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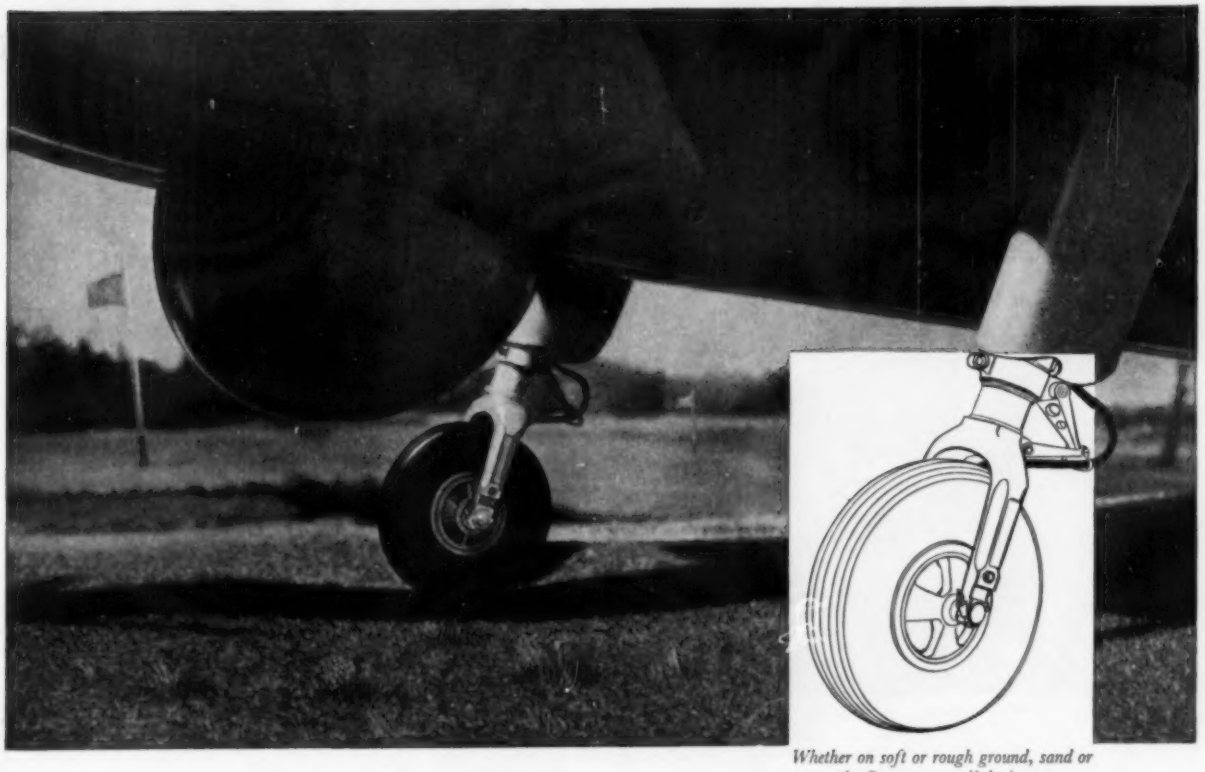
Golf course fairway — *Seamew* runway



Whether on soft or rough ground, sand or grass, the Seamew can alight in an extremely small area because of its low landing speed and long oleo leg travel. Tyre sizes can be easily changed to suit terrain.

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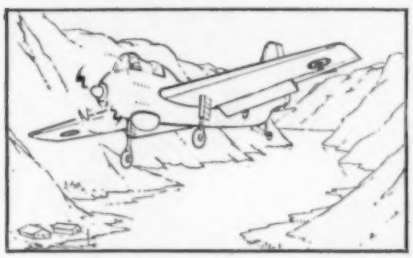
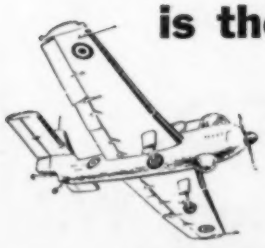
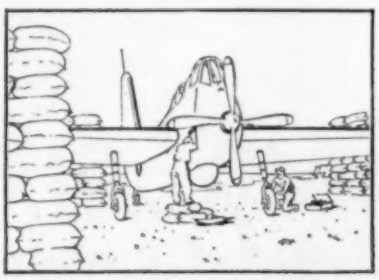


The extremely good handling characteristics of the Seamew combined with simplicity of construction and clear vision make it an excellent aircraft to fly, even for pilots with little experience of this type.

The *Short* answer is the *Seamew*



Economy of manufacture is paralleled by economy of maintenance, in terms of man-hours and spare components.



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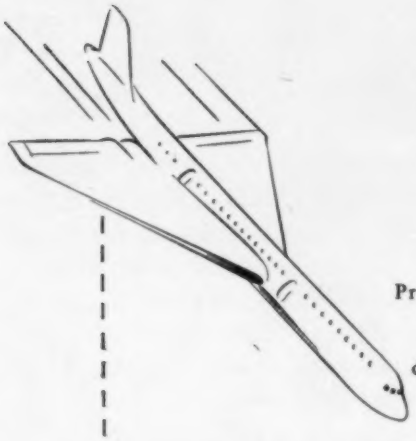

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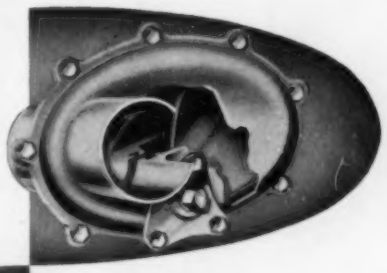

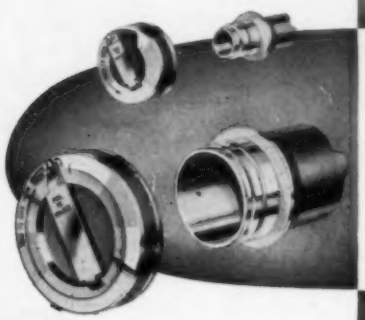

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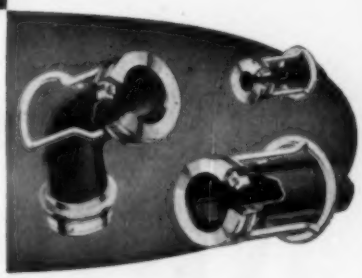

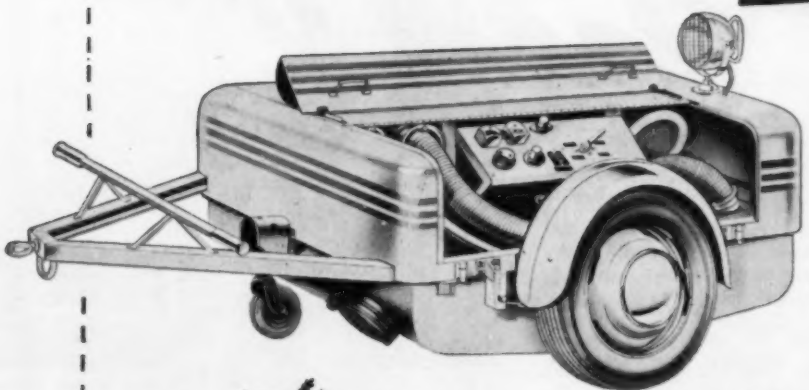

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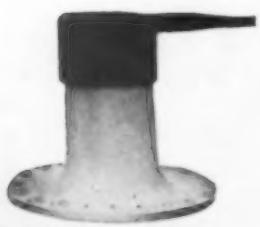

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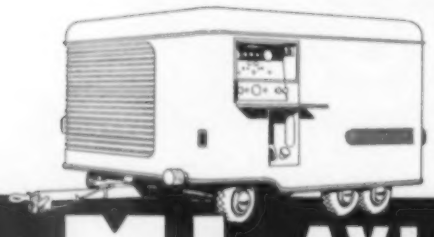

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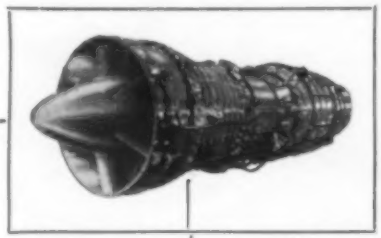

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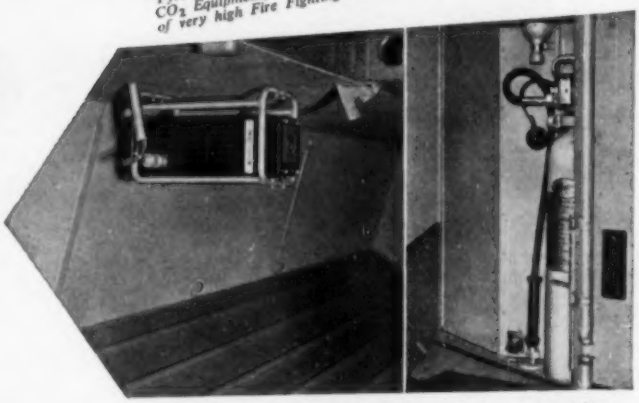

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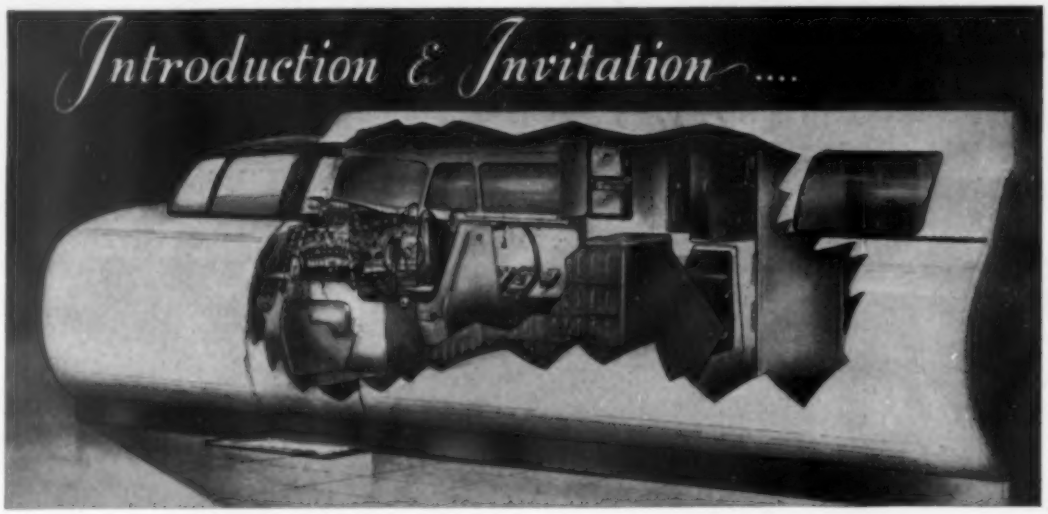

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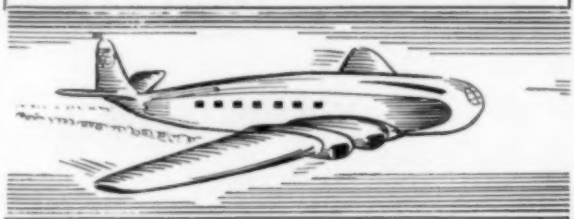

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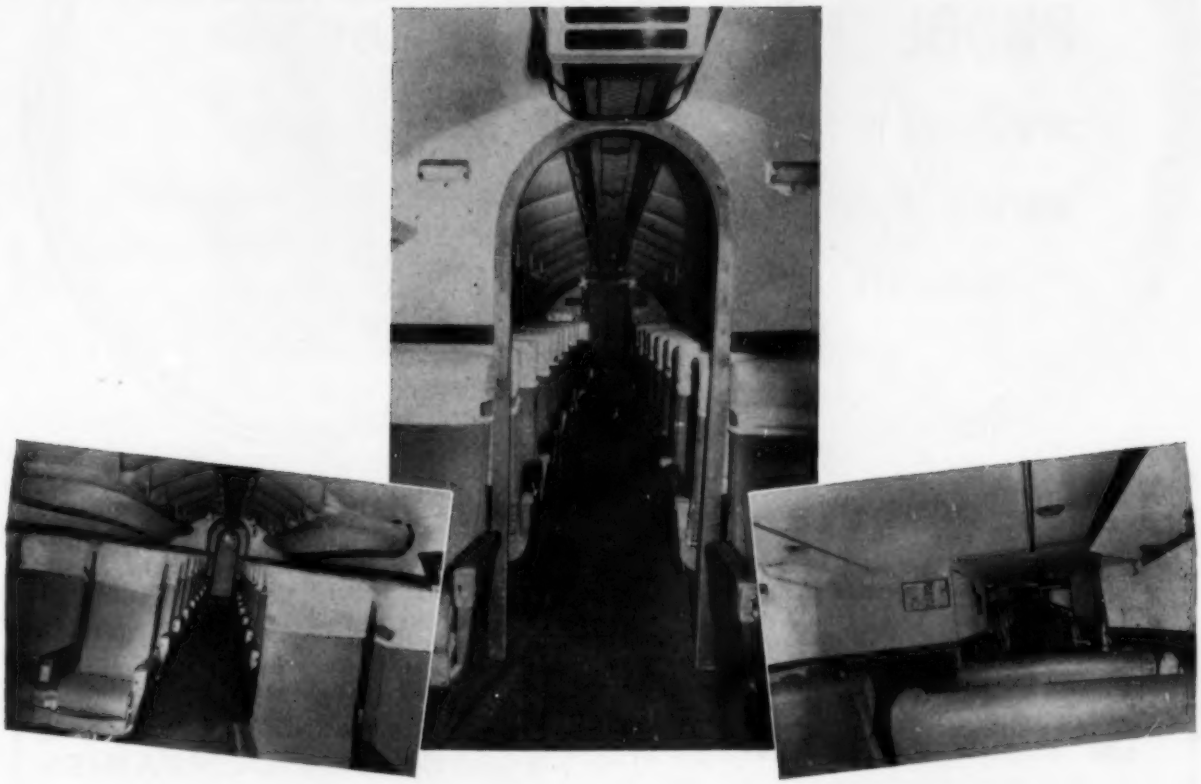

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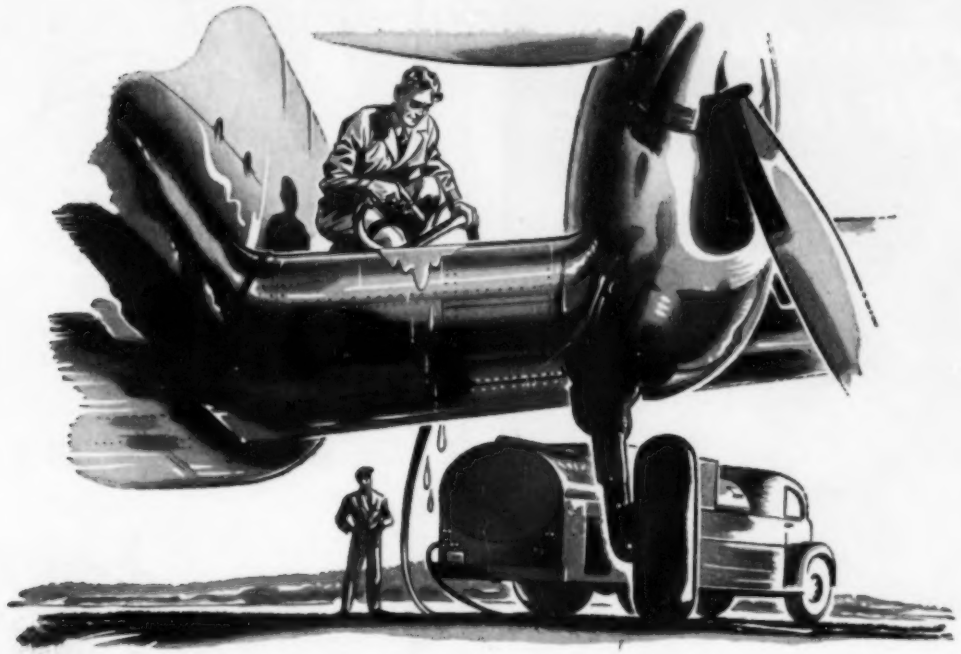
. . PAINT versus ALCOHOL . . .



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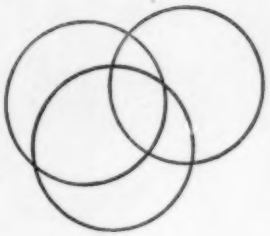

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FLIGHT
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AIRCRAFT ENGINEER

First Aeronautical Weekly in the World

Founded 1909

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Business with Pleasure

AMONG various important aspects of air transport—the subject of this special issue of *Flight*—are two which deserve separate consideration. The first is competition, and its effects upon the development of civil aviation.

Our own studies convince us that, without the stimulus which competition affords, the post-war airline industry would still be little more than half-way towards its present size and status. The steadily diminishing cost of air travel has, of course, been the prime factor behind its acceptance by the public as an everyday means of transport in most parts of the world. Theory might say that smaller numbers of larger airlines could carry the traffic more cheaply still. Experience has shown that small airlines with low overhead costs, plus the spirit of enterprise which very often thrives best in such organizations, have taken the first steps towards offering cheaper air travel. Bigger companies, sometimes reluctantly, have followed suit and have afterwards found it worthwhile to do so.

Competition of this sort has normally been confined to domestic or colonial routes, but its effects have been widespread. The tourist fares policy introduced by the large international airlines, for example, had its origins in the early post-war efforts of the gallant but sometimes unruly American "non-sked" operators flying war-surplus aircraft. With the introduction of tourist fares on a global basis it is now possible to circle the world by air for less than £450.

At the same time, it is clear that the community has been adequately safeguarded from the dangers of over-competition between the airlines. Not only have governments, by and large, played their part in encouraging an economic degree of healthy competition, but the airlines themselves have evolved, in I.A.T.A., a fair means of protecting both themselves and their passengers from the cut-throat tactics.

The Second Aspect

Since the beginnings of powered flight fifty years ago men have taken to the air for the sheer satisfaction of moving in a new dimension. Part of this satisfaction comes from personal mastery of the laws of gravity and the moods of the air, and many fine books have been written on the subject. The contents of this issue, however, remind us that today the great majority of airborne travellers are not pilots but passengers. Despite the disparaging remarks so often made about airline travel—and a marked preference, even in the aviation world, to travel "B.O.A.T." whenever saving of time is not the first consideration—we contend that real satisfaction is to be derived from passive as well as active flight.

Admittedly, anxiety occasionally reduces the enjoyment of air travel. This probably applies to knowledgeable people, especially pilots, whose reluctance to leave control of the aircraft in other hands is quickened by every change in sound and attitude. For the majority, however, it is possible to relax in the knowledge that scheduled airline travel is by far the safest type of flying.

The visual enjoyment of flight in airliners is benefiting greatly from higher cruising altitudes and, in some cases, the use of larger windows. Even the conquerors of Everest, alone in the Himalayas, were denied some of the sights to be seen in armchair comfort on everyday journeys by airline passengers. With the help of the excellent maps usually issued by airlines to passengers, study of the landscape can be combined with the pleasant exercise of amateur navigation. When sea and land are out of sight there are usually magnificent, ever-changing cloudscapes to be admired.

And while it is natural to cavil at the ground part of an airline journey, even the coach ride to the airport and transition through the formalities of departure help to foster that tingle of anticipation which is felt by all but the most blasé of travellers.

In bygone years travel was the basis of practically all stories of romance and adventure. There is no reason why this should not be so today, for aviation has added the dramatic element of speed to all the traditional ingredients of travel.

FROM ALL QUARTERS

Viscounts for Africa

IT was announced on Saturday that the Federal Government of Rhodesia and Nyasaland have authorized the purchase by Central African Airways Corporation of five Series 700 Viscounts. The airline's general manager, Mr. P. J. B. Wimbush, has said that the Viscounts, which would probably be equipped as 48-seaters, would replace the company's Vikings on the main domestic and regional routes and would also take over the Zambezi (Colonial Coach) service to London. This announcement was foreshadowed in *Flight* of May 14th. It is believed that East African Airways Corporation are also likely to place an order for Viscounts.

B.O.A.C. Profit

PROVISIONAL operating and financial results for B.O.A.C. during the year ended March 31st were announced last week in a message from the chairman, Sir Miles Thomas, to the Corporation's employees. Ton-miles offered for sale totalled 220,467,460, compared with 214,550,753 during the previous financial year, and the number of passengers carried increased from 290,629 to 300,800. Total expenditure per ton-mile offered was reduced from 40.1d to 39.6d, and at the same time there was an increase in the rate of revenue per ton-mile performed—62.1d in the latest financial year, compared with 60.7d for the preceding twelve months. The result is a surplus, after payment of interest on capital, of £1,072,600 compared with a deficit of £838,664 for 1952-53.

Comet Inquiries

THE appointment of Lord Cohen to preside over the public inquiries into the causes of the two recent Comet disasters off the Italian Coast was the subject of simultaneous announcements in both Houses of Parliament on May 12th.

Sir Lionel Heald, the Attorney-General, informed the Commons that the Government were anxious that these inquiries should be held as soon as possible, although the date on which they were likely to begin could not yet be indicated. Salvage operations were still going on, and an exhaustive technical investigation was being carried out under the co-ordinating authority of the Minister of Supply.

In view of the great importance of these inquiries, it had been decided that they should be presided over by a Lord of Appeal, and that the same court should inquire into both cases. Lord Cohen had accepted this appointment.

The Italian Government had appointed two accredited representatives, Col. R. Miniero and Signor R. Roveri, to be present at both inquiries, and South Africa had nominated Lt. Col. L. E. Lang and Major J. J. Granzier as accredited representatives at the inquiry into the Naples accident. The names of the assessors would be announced later.

Air Transport, Ancient and Modern

FURTHER details of arrangements for the Royal Aeronautical Society's Garden Party have been issued. This year's event takes place on Sunday, June 13th, at London Airport, and it is now known that among the transport aircraft which will be available for inspection by members and their friends are a T.C.A. Super Constellation and a B.E.A. Viscount. Special buses will be available to take the visitors on conducted tours of the whole airport.

As already announced, the central theme of the occasion will be the first exhibition of the Nash Collection of veteran aircraft and engines since its acquisition by the Society.

By an odd coincidence, the central area of London Airport, where the party is taking place, is on the exact site of the pre-war R.Ae.S. Garden Parties at the old Heathrow Aerodrome, which formed the nucleus from which L.A.P. was laid out.

Attendance at the Garden Party is restricted to R.Ae.S. members and their guests.

GROOMING the "Horace" (i.e., part Maurice, part Henri) Farman of the Nash Collection—now the property of the Royal Aeronautical Society — which will appear, with other historic machines of the Collection, at the Society's Garden Party, referred to above.

The National Air Race Displays

A SPLENDID collection of aircraft, old and new, will grace the "Fifty Years of Flight" display at Baginton, Coventry's civic aerodrome, in connection with the National Air Races on June 18th and 19th. Full details of the proceedings will appear next week; meanwhile the following particulars will allow intending visitors to lay their plans.

Tickets for the reserved public enclosure are now available, on written application to the Town Clerk, Council House, Coventry, or on personal application at the Council House information bureau or at Godfrey's Travel Agency, Pool Meadow. Tickets for the Friday are 2s (adults) and 1s (children under 15); for the Saturday they are 4s and 2s. There is no advance sale of tickets for the general public enclosure, admission to which will be 1s (adults) and 6d (children under 15) on the Friday and 2s and 1s on the Saturday. The car-parking charge will be announced later.

PRACTICAL EXPERIENCE of flight-testing new engines will be a useful background to W/C. J. H. Heyworth, A.F.C., in his new assignment to Rolls-Royce sales promotion in the Far East; he recently joined the company's export sales organization after relinquishing the post of chief test pilot. He is a Master Pilot of the Guild of Air Pilots and Air Navigators.

The Hermes Dispute

THE ban placed by trade-union officials on the servicing of B.O.A.C. Hermes offered for sale to independent operators was reported to have been lifted as this issue went to press. The B.O.A.C. engineers involved, who had already been advised by their unions to agree to service ten aircraft sold to Skyways, who, it is claimed, were the only operator to have agreed to any substantial number of conditions demanded by the unions, were subsequently told to prepare nine other Hermes for sale to independents.

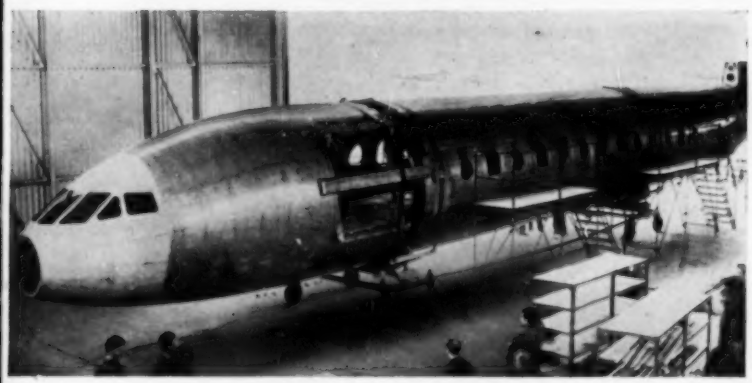
B.O.A.C. have stated that these were to be sold to Britavia (six) and Airwork (three). Last week the chairman of Britavia —parent company of Silver City Airways—announced that his company intended to issue a writ against B.O.A.C. for breach of contract. For several weeks Britavia had been repeatedly told that the next meeting of B.O.A.C. employees would resolve difficulties standing in the way of delivery of the Hermes. His company had paid a substantial deposit on the aircraft but had not been allowed to go near them, much less inspect them.

The situation was further complicated by the news that B.O.A.C. now wish to postpone the delivery of a number of Hermes (three or four, it is reported) for temporary return to service on the African routes This step would enable Argonauts to resume the South American services, which have been suspended since the grounding of the Comets early in April.

The "Formidable" Gyron

IN a reference to the Gyron at the recent annual general meeting of the de Havilland Engine Co., Ltd., Maj. Frank B. Halford, C.B.E., F.R.Ae.S. (chairman and technical director) said that it was the largest jet engine yet announced—and in point of fact they did not know of any prototype engine in the world which had comparable output today or potentiality for the future. "Even at the start of its design life," said Maj. Halford, "it had a most

IN THE COMET'S TRAIL: Ahead of schedule emerges Boeing's 707 tanker/transport prototype (right) in which the company has invested some 15 million dollars. The first flight should take place next month. Below is the fuselage shell of France's S.N.C.A.S.E. Caravelle (two Avons), which embodies the entire cockpit section of the Comet.



formidable power, and it marks the advent of a new generation of supersonic aircraft. I am not permitted to reveal its technical features, except to say that its compressor is of the axial type . . .

"We undertook the first stage of development of this large and costly project as a private venture, and we were gratified when at the early test-bed stage the Ministry of Supply decided to give their full support to its further development . . . I am now permitted to make it known that the Gyron soon passed a test equivalent to that required before engines are approved for flight.

"We are confident that the Gyron in its original and developed forms will prove to be one of the principal power units available to aviation in the period up to about 1965."

The annual general meeting of the de Havilland Aircraft Co., Ltd., to which we referred last week, takes place at Hatfield next Friday, May 28th.

Managing Hatfield's Production

NOW production manager of de Havilland's Hatfield works is Mr. P. W. Grigsby, whose appointment to this post took effect on May 1st. Mr. Grigsby joined the company in August 1928, working as an artisan on all the D.H. types which were produced between 1928 and 1939. He showed great ability and, as a result, was transferred to the experimental department, where he became concerned with the building of prototypes. He was selected as one of the team to go to Salisbury Hall, where, in 1940, he played a leading part in the building of the prototype Mosquito. As a result of his zeal and initiative in the subsequent development of this type he was awarded the British Empire Medal. In 1948 he was promoted to the position of superintendent of the experimental department and, under the direction of Mr. Rex King, had much to do with the production of the Comet 1, 2 and 3 prototypes. Last year he was transferred to the production department to assist Mr. H. Povey with the control of all civil-aircraft production, and was soon appointed factory manager under the late Mr. "Jock" Allardyce.

Mr. P. W. Grigsby.

Qantas Trans-Pacific Service

THE first of eight new Super Constellations ordered for the long-range services of Qantas Empire Airways left Sydney last Saturday (May 15th) on the Australian company's inaugural service to San Francisco and Vancouver. Operated with DC-6s since April 1948 by B.C.P.A., the service was recently added to the Qantas network under an agreement between the British, Australian and New Zealand Governments.

Aboard the Super Constellation were Sir Hudson Fysh, chairman and managing director of Qantas, and Lady Fysh, Ald. P. D. Hills, Lord Mayor of Sydney, Mr. G. P. N. Watts, chairman of Australian National Airways Commission and a party of Australian journalists. Temporarily at least, the new service follows the same schedule as the old, although the larger capacity of the Constellations has enabled Qantas to reduce the frequency from three round trips weekly to two. One service per fourteen days terminates and returns from San Francisco.

Under the revised arrangement for operating this Commonwealth Pacific route, some 300 former B.C.P.A. personnel have been absorbed by Qantas. The three DC-6s have now been handed to Tasman Empire Airways as replacements for the Solents used successfully since 1949 to link New Zealand witb Australia.

T.C.A. Super Constellation Inauguration

IN the early morning of May 10th T.C.A.'s first Super Constellation, CF-TGC, arrived at London Airport after its first Atlantic crossing. A special guest on board was Mr. J. A. D. McCurdy, who was the first man in the British Empire to fly a heavier-than-air machine; he made his first flight in Nova Scotia in 1909, in a machine built by Alexander Graham Bell—inventor of the telephone—and himself.

T.C.A. had intended to establish an R.Ae.C.-observed flight-time between Montreal and London (3,251.2 miles) on this crossing; but unfavourable weather interfered.

Later in the day the Super Constellation took off from London Airport with a full complement of the company's guests on board. For an hour the passengers sampled the comfort and spacious layout of the aircraft as it cruised over the south of England at about 220 m.p.h.

The day was very warm [writes a *Flight* representative who was on board], but the air-conditioning system fed volumes of cool air into the cabin, even on the ground and before the engines were started. The air entered through a series of adjustable louvres and also through hinged ceiling-hatches. This was achieved at the expense of a good deal of electric motor noise and hissing of air, but in cruising flight the noise level both from these sources and from the power plants was not such as to render conversation inaudible.

The aircraft "rode" a moderately bumpy atmosphere well and there was ample space for movement despite the fact that both forward cabins were arranged for five-abreast tourist travel. Although almost all the passengers were constantly on the move no bottlenecks developed, even at the source of all goodness—the galley. Toilets—four of them—were excellently appointed with hot, cold and drinking water and cardboard cups, and large properly angled mirrors. The forward toilets have been placed in the line of the airscrews but, curiously enough, the noise between the compartments is more obtrusive than within them. In the 15-seat cabin forward of these, some vibration is apparent in most flight conditions.

"Tube effect" in the very long fuselage has been completely

FROM ALL QUARTERS...

avoided by careful placing of the bulkheads and by large rectangular ceiling lighting panels which break and raise the otherwise tunnel-like roof. T.C.A.'s interior colouring, in rust-brown upholstery with pale-grey ceiling, is restful and has a luxurious air. The passenger accommodation in general is so extensive that it is quite easy to regard it as one would a ship, where one is very little concerned with the mechanics or function of the hull. In the Super-Connie one easily forgets such baser regions as wings and tails.

T.C.A. inaugurated a two-class Super-Connie trans-Atlantic service, with four flights per week, on May 14th. This frequency will be increased to a daily service on June 15th.

F. P. Raynham

MANY who knew him in the early flying days, and between the wars, will be grieved to learn of the death of F. P. Raynham, O.B.E. Sixty years of age, he died suddenly on April 30th at Colorado Springs; for the past six years he had been touring the United States, in company with his wife, in a trailer caravan.

Frederick Phillips Raynham was an early associate of Sir Alliott Verdon-Roe. He took Aviators' Certificate No. 85 on a Roe biplane at Brooklands in 1911, a few weeks before his 18th birthday, and soon he was an outstanding pilot in that early colony of aviators who included Tommy Sopwith, Harry Hawker, Gordon Bell, and Ronald Kemp—with whom he was later associated in the Air Survey Co.

F. P. Raynham.

At Brooklands he flew regularly for A. V. Roe and Co., Martinsydes, and Sopwiths and free-lanced for others. On October 24th, 1912, he established a British Duration Record of 7½ hours on an Avro with 60 h.p. Green, and he won many races and flying prizes, mainly at Brooklands and occasionally at Hendon.

In the early summer of 1914 he caused a sensation while flying the first Avro 504 (80 h.p. Gnôme) at a Hendon race meeting; he climbed to over 12,000ft over Hendon, switched his engine off and, with a following wind, landed at Brooklands—more than 20 miles distant—without restarting the engine.

Throughout the 1914-18 war he tested hundreds of Martinsyde scouts.

In 1919 he took a Martinsyde with Rolls-Royce to Newfoundland to try for the *Daily Mail* Atlantic prize. Soon after Hawker and Mackenzie Grieve left on their historic attempt, Raynham crashed while trying to take off in his heavily loaded aircraft; he and his navigator, W. Morgan, were uninjured but badly shaken.

He flew a Martinsyde Semiquaver for Britain in the first post-war Gordon Bennett Race in France, but engine trouble prevented him from finishing the course.

In the first King's Cup Race in 1922, Freddie Raynham, flying a yellow Martinsyde F.6, finished second to F. L. Barnard in an exciting contest round Britain. Later that year he made the first real soaring flight ever seen in England—in a Handasyde glider on the second day of the Itford Hill gliding meeting. He soared for 1 hr 53 min, a duration which remained unbeaten until the Frenchman Maneyrol stayed up for three hours in a half-gale in the very last hours of the meeting. Raynham was awarded the Britannia Trophy for 1922 for his flight.

He competed in the light aeroplane meetings at Lympne in 1923 and for several years thereafter, flying a Hawker Cygnet; he was "George" Bulman's predecessor in test-flying for Hawkers. Later, in association with Ronald Kemp, he formed the Air Survey Co. and went as pilot to India and Burma, where he helped to form the Indian Air Survey and Transport Co., of which he became managing director.

Mr. Raynham's sister—Mrs. B. E. Underwood, Bridge House, Long Buckby, Rugby—tells us that she will be willing to forward letters of sympathy to his widow.

TEMPLE OF GODDESSES: Nike ground-to-air guided missiles (the name is that of the Greek goddess of victory) set up for firing from their launching site, with technicians of U.S. Army Ordnance making a last-minute electrical check.

Airline Golfers

ON Tuesday afternoon of last week the newly-formed golfing society of the Foreign Airlines Association held its inaugural meeting at the Royal Mid-Surrey Golf Club, Richmond. The winners were: Singles Bogey Competition for F.A.A. Cup: S. Parry; lowest gross medal score: F. Ricardo; lowest net medal score: H. Morgan.

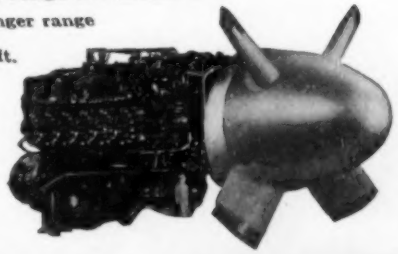
The meeting was arranged by Capt. N. W. Croucher, who—with Mr. B. Foster and Mr. A. Wagstaff—has been mainly responsible for the formation of the society. Membership is open to employees of foreign airlines operating into this country.

BEFORE TAKE-OFF: Some members of the Foreign Airlines Association Golfing Society (see above) at the first tee. From left to right are: Mr. V. Christensen (S.A.S.), Mr. A. Wagstaff (Philippine Air Lines), Mr. E. Sinclair (S.A.S.), Capt. Mucadam (Air India), Mr. J. Bamford (Air France), Colonel de Sousa (Transportes Aereos Portugueses), Mr. E. Barnes (Travel World), Mr. H. Dingwell (K.L.M.), Mr. Morgan (K.L.M.), Captain Ralph (P.A.A.), Mr. Ricardo (P.A.A.), Mr. Tucker (P.A.A.), Mr. Sidney Parry (P.A.A.), Mr. Le Mesurier (Air India) and Captain N. W. Croucher (A.N.A.). Others present were Mr. B. Cochrane (B.C.P.A.), Mr. W. Whelan (Aer Lingus) and Mr. B. Foster (Argentine Airlines).

"Flight" photograph

LONGER RANGE-on less fuel

The Nomad is a 12 cylinder 2-stroke diesel engine compounded with a turbine compressor set—the only compound diesel designed as such from scratch. It will work efficiently on kerosene, diesel oil, or wide-cut gasoline, and its fuel consumption under any operating conditions is extremely low. At every stage of design and manufacture fuel economy was the first objective. The result is longer range on less fuel for reconnaissance and freight aircraft.



NAPIER Nomad

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GBCNI

He's just been through the sound barrier

As the ceiling of modern aircraft becomes increasingly higher, instruments must keep pace with requirements. This newly developed Smiths Altimeter registers up to 60,000 ft. with the same precision as lower range instruments. The range has been extended by refinements in the linkages, the extensive use of jewels, and the incorporation of a special low hysteresis capsule. Size and weight are the same as standard Altimeters.

A short while ago he was testing a supersonic aircraft — doubtless using Smiths instruments designed for high speed flight. Special instruments for development work have always been a major consideration of Smiths, though the organisation is no less concerned with making sound, reliable equipment for everyday flying.

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SM 11

HERE AND THERE

IN PRODUCTION for R.A.F. Coastal Command and the South African Air Force is the Avro Shackleton 3, depicted in this photographic-cum-artist's impression. Features include nosewheel undercarriage, greater fuel capacity, special soundproofing, a well-appointed wardroom and improved cockpit canopy. Squadron deliveries should begin this autumn.

Big Order for Bristol 173s

A MINISTRY OF SUPPLY production order for "about 100" of a military version of the Bristol 173 helicopter was announced by Mr. Duncan Sandys in the Commons last Monday. He added that "a larger type, with gas-turbine engines, capable of carrying up to 27 passengers," was also planned. He also revealed that, since 1946, the M.o.S. had granted £1,756,000 for helicopter research and that the 1953-54 estimate was £1,256,000; for 1954-55 it might be over £2½m.

Personal Inspection

THE Editor of *Flight* returned on Tuesday last from his two-month world-circling air tour *via* Canada, the United States, Australia and South and East Africa. As he expected, he was able to study many developments of extreme interest in aircraft factories and other establishments.

Stokehole

CURRENT work at the Melbourne Aeronautical Research Laboratory includes investigation into the use of powdered brown coal as fuel. It is fed like a liquid into a large vessel resembling a gas-turbine combustion chamber and ignited by spark. Considerable success has been achieved, and research is in hand for a variety of applications.

Gloucester-Cheltenham Display

A WELL-VARIED programme of aerobatic and other items will constitute the programme of the air display being held on Saturday week, May 29th, at Staverton, Gloucester, in aid of local R.A.F.A. branches. Among the aircraft will be such contrasting types as a Gloster Gladiator and a Vickers-Supermarine Swift (pilot, Lt-Cdr. Lithgow), and a Gloster Javelin may also appear. The show begins at 3 p.m., and admission and parking prices are: Adults, 2s 6d; children, 1s; cars, 2s 6d; motor cycles, 1s; buses, 10s.

Another 136-mile Viking

FIRED from White Sands proving ground on May 7th, No. 10 in the U.S. Navy's series of Viking rockets made by Glenn Martin reached an altitude of 136 miles. This exactly equalled the record figure attained by Nos. 7 and 9. At its "all burnt" altitude, the 7½-ton, 41ft rocket was calculated to be travelling at 4,000 m.p.h. Like its predecessors, it was powered by a 20,000-lb thrust unit made by Reaction Motors, Inc.

For the Inner Man

A HOSTELRY on the Bath road outside London Airport was renamed *The Air Hostess* during a ceremony on May 14th. The new signboard, painted by Mr. L. Bowie, shows a B.O.A.C. air hostess standing before a Britannia. Sir Miles Thomas, who unveiled it, said that it was most fitting that a public house, which cared for "the inner man," should be named after air hostesses, whose services to air-passengers were such an important contributory factor to the success of an airline.

Saturday's Naval Air Day

THIS Saturday, May 22nd, Royal Naval Air Station Yeovilton—near Yeovil, Somerset—is holding its annual Air Day. There will be a comprehensive flying display, in which manufacturers' aircraft will also participate. Gates open at 12.30 p.m. and flying starts at 2.30.

Cierva Essay Competition

THE Helicopter Association has issued details of the 1954 Cierva Memorial Prize essay competition. First and second prizes of £35 and £15 respectively will be awarded to the competitors—of any nationality, but under 26 years of age at the closing date, December 31st, 1954—submitting the two best papers on any subject connected with rotating-wing aircraft. Entry forms are obtainable from the Association, at 4 The Sanctuary, Westminster, London, S.W.1.

SEEING THE BEVERLEY: Above, A.V-M. G. R. Beamish, A.O.C-in C. Transport Command, during a recent visit to Blackburn and General Aircraft, is shown round by Mr. Eric Turner (managing director). Also in the picture are A. Cdre. V. D. Morshead, S.T.S.O. of Transport Command, and—"liaising" at Brough—S/L. A. St. J. Price.

LORD DE L'ISLE AND DUDLEY, the Air Minister, in the picture on the right, sees an English Electric missile under vibration test at the company's guided-weapons establishment. At right is Mr. L. H. Bedford, in charge of the English Electric missile programme.

POWER FOR AIR TRANSPORT

The Choice of Engines: Dr. Russell's Wright Memorial Lecture

Part I

Dr. A. E. Russell

LAST evening, May 20th, saw one of the outstanding occasions in the Royal Aeronautical Society's year—the delivery of the 42nd Wilbur Wright Memorial Lecture at the Royal Institution, and the presentation of the Society's awards. These awards—due to be presented by Sir Sydney Camm, the new president—were listed, with the names of the recipients—on page 603 of our last week's issue.

This year's paper, entitled *The Choice of Power Units for Civil Aeroplanes*, was the work of Dr. A. E. Russell, D.Sc., F.R.Ae.S., F.I.A.S., director and chief designer, Aircraft Division, the Bristol Aeroplane Co., Ltd. Abstracts from the first part of his masterly survey are given here; others, from subsequent sections, will be given next week.

Dr. Russell's paper began by discussing the broad background to his subject, and in doing so made some highly pertinent and entertaining points. Anyone engaged in civil aviation, said the author, would hear from time to time the assertion that all the airlines had to sell was speed. A variation on this theme was the claim that, if a competing aircraft justified a shorter scheduled block-time by a relatively small margin, then the purchase of equally fast aeroplanes became inevitable. At the same time some airlines—especially abroad—had been heard to state that the introduction of a new type was unjustified unless it was at least a hundred miles an hour faster than its predecessor. Another view expressed was that, as travelling public would not tolerate higher fares, gains in performance must not be bought at the expense of higher operating costs.

It was apparent that what the travelling public was most prepared to buy was not well understood—within the condition, of course, that the airlines must operate under some acceptable standards of economics. For this reason an old occupational instrument, the kaleidoscope, was much in fashion. Pieces, representing speed, route conditions, fuel reserves, payload and other factors were introduced and the whole given a series of twists so as to produce a variety of arrangements. The picture presented became more or less complex according to the number of reflections.

This was a reasonable simile for a civil aircraft designer's endeavour to devise and engineer aeroplanes whose qualities combined to satisfy both the most canny and the most impatient passengers. In this operation the hinge-point in each picture was the form of power unit adopted, for it was around its characteristics that the pattern of the aeroplane was moulded.

It was implicit that within any such analysis some solutions would be discarded on the grounds of failure to comply with standards of safety. Here, at least in principle, all must be in full accord.

Dr. Russell then went on to explain that he intended to classify his comparison of civil aircraft fitted with various forms of engines under four headings: (1) review of power-unit performance; (2) variation of aircraft size with still-air range; (3) determination of aircraft size for particular routes; (4) estimated operating costs.

The major engine characteristics that were of direct interest to the aircraft designer were specific fuel consumption; installed weight; suitability for installation whereby the least penalties in aircraft weight and drag were incurred; and flexibility of power output so as to allow wide limits of speed and height of operation.

The different forms of turbine engine—the turbojet, the ducted fan and the turboprop—represented a different relative emphasis on these various factors. The common basis was that all these engines could be regarded as operating on the same thermodynamic cycle for producing heat energy. Their difference in overall performance characteristics stemmed largely from the particular methods adopted for converting this energy into thrust, and the efficiency of the conversion. For example, specific fuel consumption and specific power output were closely linked with the overall efficiency, which was influenced not only by the thermal cycle efficiency but also by the dynamics of the mass of air energized.

In the gas producer, the more important design parameters that controlled cycle efficiency were the compressor pressure-ratio, the turbine inlet temperature and the operating efficiency of compressor and turbine.

The Turbojet.—Fig. 1 showed the form of relationship between these design parameters and specific fuel consumption and specific power output for turbojets. Each point on the curves represented a separate engine in a family having constant component-efficiencies. The values of efficiency used represented advanced standards of development and were likely to approach the limits of practical achievement.

The curves showed that specific fuel consumption rose with increased turbine inlet temperature, in spite of the better thermal-cycle efficiency. The reason was that with the higher jet velocities the propulsive efficiency fell to an ever greater degree. Better fuel economy was reached by moving towards lower specific power, which implied greater engine weight. Thus for a particular aircraft application there would be an optimum turbojet, that is to say one in which the combined weight of installation and the fuel required was a minimum.

It could be inferred from Fig. 1 that the potential improvement of turbojets for use in subsonic civil aircraft was confined to relatively small advances. The only way to reduce fuel consumption substantially and to take the maximum possible advantage of higher operating temperatures was to reduce the kinetic energy wasted in the jet. This could be achieved only by

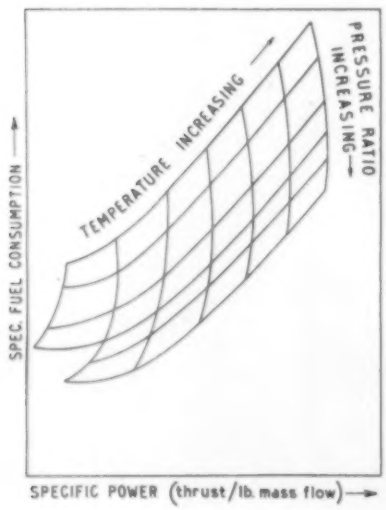


Fig. 1. — Turbojet cruise performance: Relationship between design parameters, specific fuel consumption and specific power output.

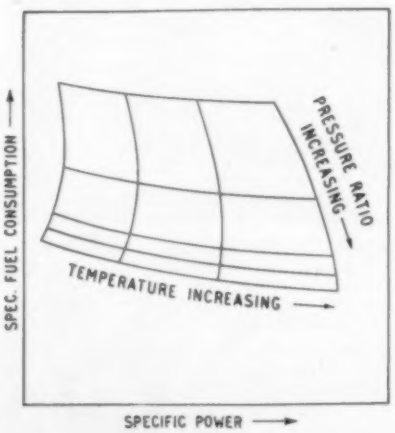


Fig. 2.—Turboprop cruise performance: Same values of pressure ratio and component efficiencies as in Fig. 1, but with deductions for additional mechanical losses in reduction gear.

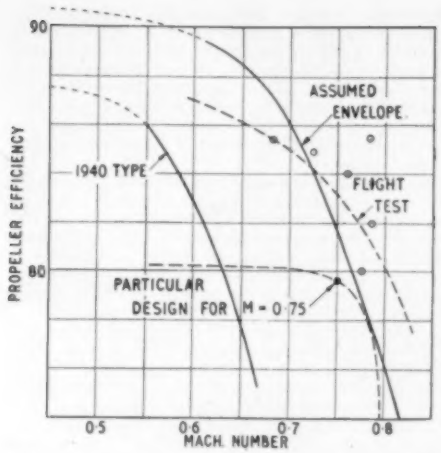


Fig. 3.—Free-air efficiencies obtained by extension of Standard Method, corrected for propulsive efficiencies for an airscrew designed for cruising at M = 0.75.

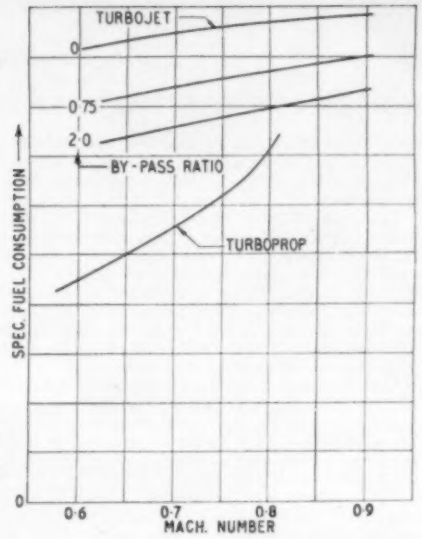


Fig. 4.—Probable specific fuel consumption for ducted-fan engines, compared with turbojet and turboprop of comparable development.

adding to the propulsive system some means of increasing the mass of air energized.

The Turboprop.—The limit that could be reached in increasing the mass of air energized was obtained by absorbing the gas energy by additional turbine stages, the power being transmitted by mechanical coupling to an airscrew. Fig. 2 showed the modified relationship between the design parameters and engine performance. It was apparent from these curves that the modified propulsive system was successful in realizing a benefit from the higher thermal efficiencies arising from increased cycle temperature. Higher turbine inlet temperatures now yielded compatible trends towards lower specific fuel consumption and also higher specific power output. Thus blade working temperature-limitations became a positive restriction in the design of high-economy turboprops; developments in this direction could therefore be expected to lead to further gains.

Airscrews.—The lecturer next considered airscrew performance, remarking that the compressibility allowances in the S.B.A.C. performance calculations, as applying to aircraft of very high performance, needed modification. At high Mach numbers compressibility was a major factor influencing efficiency and it was necessary to relate the blade characteristics to helical speed.

The two major airscrew companies in England had recently introduced refinements into the Standard Method to improve the accuracy of calculated performance. One used the strip method applying local section lift/drag ratios corrected for compressibility; the other employed an extension derived from wind tunnel tests made in America. These tests covered a wide range of blade geometry up to 0.8 M forward speed, so it was possible to obtain blade-profile drag at appropriate values of thickness/chord ratio, blade mean lift coefficient, aircraft speed and advance ratio. This extension to the Standard Method was particularly useful in the initial design of blades, to arrive at the optimum blade-width, thickness ratio and camber. Both methods gave substantially the same results. Fig. 3 showed the free-air efficiencies so obtained corrected to propulsive efficiencies for an airscrew designed for cruising at M = 0.75.

The Ducted Fan.—At one end of the scale, the turbojet possessed, among its many attractive qualities, an inherent need of high calorific nourishment; at the other end, the turboprop showed signs of moderate temperance but exhibited a physical inaptitude towards excessive speed. Somewhere between these two forms lay the ducted-fan engine, the cross-breed designed to moderate these deficiencies. There were few examples and little information, so only future prospects could be suggested.

The ducted fan consisted of a low-pressure compressor or fan driven by a power turbine similar to that employed in a turboprop. Such a fan could induce a significant mass of air to augment that passing through the gas producer, so improving the Froude efficiency of the propulsive system. Being enclosed within a duct, the fan operated in a flow of reduced velocity, thereby postponing the adverse effects of compressibility. The magnitude of the improvement to the propulsive efficiency as compared with the simple turbojet would depend upon the by-pass ratio. This was defined as the ratio of fan mass flow to engine mass flow, so the ratio for the simple turbojet was zero.

The proportion of air actuated (i.e., the by-pass ratio) was open to choice, always remembering that the greater the mass of air the lower the compression ratio and the heavier the machinery. On balance it was unlikely that the ratio would much exceed 2.0, so it might be assumed that representative values of 0.75 and 2.0 would cover the probable field.

The ducted-fan engine would not, of course, achieve the ideal gain as suggested by the simple relationship between by-pass ratio and Froude efficiency. There had to be losses at the fan, in the final nozzle and skin friction in the duct. Also, in the practical case, mixing of the two streams by inter-penetration would involve additional energy losses. The gains in propulsive efficiency, for by-pass ratios of 0.75 and 2.0, were approximately 8 and 16 per cent respectively when compared with a straight jet engine of the same gas producer standard.

Likely specific fuel consumption for ducted-fan engines could not be inferred, and these were shown in Fig. 4, together with comparative values for turbojets and turboprops of comparable development standard.

Engine Installed Weight.—In ascribing values to specific fuel consumption no variation was included to allow for differing sizes of engine. A detailed analysis had shown that performance did, in fact, improve in engines of higher mass flow, although the rate of improvement progressively decreased. On the other hand specific weight moved in the reverse direction. As a consequence, for conditions appropriate to flights of medium and long duration, the two effects tended to cancel each other out. Because of this, the weight of turbojet engines would be taken as directly proportional to their design mass-flow, this flow being adjusted to produce the thrust required to meet the cruising conditions of the relevant aircraft. The value for the total installed weight would be taken as 21 times the design mass-flow.

On the basis of equal mass-flow the weight of a turboprop engine was appreciably greater; the obvious reason was the additional mechanical complication, including the airscrew reduction gearbox. In consequence, the mass-flow factor to give engine installed weight, less airscrew, had to be increased from 21 to about 50. The mistake should not be made of using these two figures directly to compare relative engine weights. Not only was the mass flow required to produce a given thrust profoundly influenced by the propulsive efficiency of the particular system, but, also, the thrust required varied with the size of the related aircraft and its operating altitude. A fair comparison could only be made after different engines and aircraft had been matched to a given operational specification.

Confidence in the assumptions relating to ducted-fan engines was less well-founded, because suitable data were very limited.

TABLE I: Assumed engine static performance in terms of design air mass flow A_m.

Type of Engine	Installed Weight W_{EI}	S.L. Static Thrust T_S	$\frac{W_{EI}}{T_S}$	S.F.C.
High-temperature turbojet	21 A_m	68 A_m	0.31	0.80
Low-temperature turbojet	21 A_m	57 A_m	0.37	0.71
Ducted fan, λ=0.75 ...	28 A_m	86 A_m	0.325	0.625
Ducted fan, λ=2.0 ...	37 A_m	109 A_m	0.34	0.49

TABLE II: Each engine to give 3,000 lb. thrust at M = 0.85 at the I.S.A. tropopause. Engine A is a high-temperature turbojet, B is a low-temperature turbojet, C is a ducted fan (λ=0.75) and D is a ducted fan (λ=2.0).

	A	B	C	D
$T/\delta A_m$	93.5	76	104.5	113
A_m	138	172	128	119
$(1+\lambda) A_m$	138	172	223	357
Dia. (in.)	33.5	37.0	41.0	50.5
Installed weight (lb.)	2,900	3,600	3,600	4,400
S.F.C.	0.98	0.91	0.87	0.805
S.L. static thrust (lb.)	9,300	9,800	11,000	13,050

POWER FOR AIR TRANSPORT . . .

In addition, estimates of their installed weight were more complicated, because suitable engineering arrangements would probably differ according to whether the particular by-pass ratio was high or low.

Assumed Engine-data.—The various engine performance characteristics that controlled aircraft performance could now be gathered together. It was important to remember that, in this collection, the actual figures given did not refer to any particular existing engines but to a hypothetical group of equal development standard, and based on common theoretical and technical ground. It must not be expected that engines with differing pressure ratios, compressor and turbine efficiencies or turbine inlet temperature would conform.

A summary of the static performance of a group of turbojet and ducted fan engines, based on the preceding data and assumptions, was given in Table I. The outstanding variable was the design air mass-flow, which might be adjusted to suit any aircraft performance requirement. It was assumed that complete freedom remained to select any desired value.

The static thrust and specific fuel consumptions quoted were calculated by the standard methods appropriate to the heat-engine cycle and, as explained earlier, assumed highly sophisticated component-design.

Performance at altitude and at any speed might be calculated in like fashion.

It was necessary, however, to introduce certain adjustments for normal installations. Pressure losses in the intake system reduced thrust and increased fuel consumption. The same adverse effects arose if air was bled from the compressor to provide cabin pressurization. Moreover, whatever the form of drive, power had to be absorbed in working the accessories. Because of these things a larger engine had to be provided and more fuel would be consumed than would be the case for an engine operating under ideal conditions.

Typical corrections were included in Table 2, which showed the derived engine characteristics consequent upon a stated requirement to produce 3,000 lb of thrust at 0.85 Mach number at the I.S.A. tropopause. This form of calculation would be followed in the subsequent aircraft analysis.

It could be shown that the weight of the turboprop installation was rather more than twice that of the turbojet for equal net thrust, but the specific fuel consumption was rather less than two-thirds.

It was worth while to pause at this point in order to make a tentative comparison. Taking typical values of aircraft drag/lift ratios (i.e., thrust/weight), turbojet and turboprop engine installations would be approximately 6 and 12 per cent respectively of the aircraft gross weight (these percentage weights would only apply when the initial cruising altitude was at the tropopause). A process of simple arithmetic now showed that for equal thrust the weight of combined engine plus fuel was equal for the two types of engine at approximately 1,350 miles still-air range; this result, however, must be qualified by reason of differences in take-off performance allowances.

Aircraft Derivation. The stage now reached, said Dr. Russell, was highly idealistic; a large range of engines of turbojet, ducted-fan and turboprop form was assumed to be available to the aircraft designer, in any size he cared to specify. He might have complete confidence that each engine, whichever one his choice might be, would be as fully developed as any other and be capable of delivering its full performance at the time at which an aircraft could be prepared and made ready to begin its flight trials.

In this happy state of affairs the next move took them into the province of aircraft initial-project design and here, too, some infallibility of skill in prediction must also be assumed.

For civil operations, particularly on medium- and long-range routes, it was not unreasonable to assume that the specified basic requirement was the carriage of 25,000 lb of payload, a load equivalent to approximately 100 tourist passengers plus a small amount of freight. This, with normal volumetric allowances, was used to fix the dimensions of the body. Alternatively, the same weight and space might be arranged to accommodate a smaller number of passengers with greater facilities for their comfort. Here, however, the body might be treated as a whole, with overall allowances for drag and weight whichever type of engine was being considered.

With the overall dimensions and the surface area of the body so established, its consequent drag could be estimated without difficulty. It was likely that parallel estimates for suitable weight allowances showed more variation. Such possible discrepancies, however, were not important and became an independent variable within a related set of aircraft performance calculations. Each aircraft in the family started equal, in so far as it might be affected by the number of passengers carried and the provisions made in their immediate environment. Quite clearly, if an attempt was made to introduce into this standardized pattern an independent aircraft, for which different standards applied, it was probable that some adjustment would be necessary.

The task in the next part of the paper was to find the size and shape of a group of aircraft, all of which had the same size of body and which carried a constant payload for various distances. *(To be continued)*

DEATH OF QANTAS PIONEER

THE death—in Sydney on May 7th—of Mr. W. A. Baird, who for nearly 30 years was chief engineer of Qantas, severs another link with the pioneering days of commercial aviation in the British Empire.

Born in Victoria 63 years ago, Arthur Baird served an engineering apprenticeship in Melbourne and served in World War I in the Australian Flying Corps. He taught himself to fly in obsolete and condemned aircraft, and later took an official flying course at Point Cook.

Early in 1919 the Australian Government offered a prize of £10,000 for the first Australian airmen to fly between England and Australia in a British aircraft within a period of 30 consecutive days. Baird was chosen as engineer by Hudson Fysh (now Sir Hudson Fysh) and Lt. T. J. McGuinnis. Although the flight never materialized, it marked the beginning of an historic partnership, the first stage of which was the establishment in 1920 of Queensland and Northern Territory Aerial Services, Ltd. —the original Qantas.

For many years Arthur Baird piloted Qantas aircraft between Brisbane and Camooweal and carried out a great number of survey and proving flights. As works manager at Longreach he supervised the building of the first civil aircraft to be constructed wholly in Australia. He held Engineer's Licence No. 25 in all categories covering all types of engines and landplanes; British Air Ministry Licence No. 4387, covering flying-boats; and Commonwealth "A" and "B" pilot's licences.

When the Japanese over-ran the Far East in World War II, Baird set up and staffed a base in Western Australia in 1943 for an alternative route to England.

Although Arthur Baird had retired from his post of engineer manager he could not keep away from aviation and after a world trip in 1949 he continued to serve Qantas in various capacities. On the day of his death he had been to Broken Hill to advise on future developments of the Flying Doctor Base there.

After his funeral in Sydney on May 10th, club aircraft and the recently delivered Qantas Super Constellation flew past in salute to the memory of a well-loved Australian pioneer.

MR. J. W. ROFFEY

FROM Sangamo Weston, Ltd., we learn with regret of the death of Mr. J. W. Roffey, their London area manager, in a car accident on May 12th while returning to London from the British Industries Fair at Birmingham.

Mr. Roffey, who was 45 years of age and leaves a widow and three daughters, had been with the company since 1924, where he was first employed in the test room. After gaining experience in all production departments, he became contracts engineer in 1936. During and since the war he specialized largely in aircraft instrumentation and played a considerable part in the development of many types of electrical instruments. He was appointed London area manager in 1950. Mr. Roffey was widely known, and well liked, in the aircraft industry.

CHANGING HANDS

IT was announced recently that the engineering interests of Chance Brothers, Ltd., have been acquired by J. Stone (Holdings), Ltd., whose two companies, at Deptford and Charlton, London, are well known in the aircraft industry for their foundry, electrical and other work.

Chance Brothers' activities include the manufacture of Sumo electrical submersible pumps, marine lighting, lighthouse and fog signalling equipment, and Austinlite electric generating plant, switches and instruments.

A new company will now be formed, with Mr. Bryan Preston (deputy chairman of J. Stone) as chairman and Mr. John Raymond (managing director, Chance Brothers) as managing director.

Chance Brothers will continue to manufacture the glass products for which they have long been famed, with Dr. W. M. Hampton, formerly technical director, as managing director, and Mr. C. J. S. Newman as deputy.

In advance news of this change—contained in our B.I.F. report on May 7th—a printing transposition made it appear that the British Tyre and Rubber Co., Ltd., were one of the firms involved: actually, of course, they were in no way concerned.

The following Air Lines have ordered Viscounts

AER LINGUS · AIR FRANCE · B.E.A.

BRITISH WEST INDIAN AIRWAYS

FRED OLSEN AIRTRANSPORT

HUNTING-CLAN AIR TRANSPORT

IRAQI AIRWAYS · MISRAIR S.A.E.

TRANS-AUSTRALIA AIRLINES

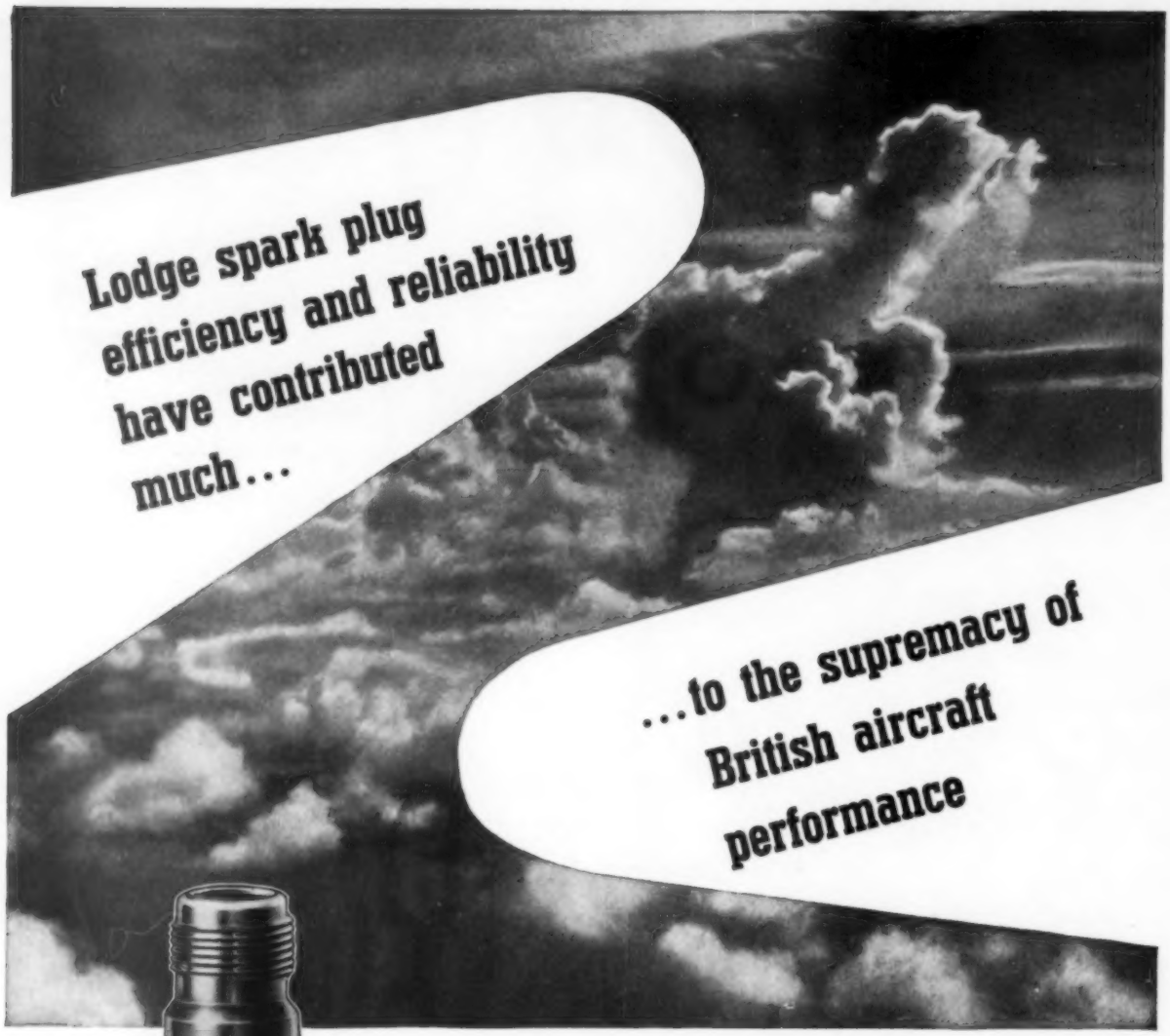
TRANS-CANADA AIR LINES

ROLLS-ROYCE

Aero

ENGINES

ROLLS-ROYCE LIMITED · DERBY · ENGLAND



The latest fleets of B.E.A. and B.O.A.C. fit Lodge plugs, and so do many other leading airlines of the world.
When giant corporations show such confidence in LODGE it can be for one reason only. Because LODGE plugs (Lodge igniters in jets) are the most efficient, most reliable plugs made to-day.

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AIRCRAFT INTELLIGENCE

SPARROWS BY NIGHT: It can now be announced that the U.S. Navy's "Sparrow One" air-to-air guided missile is in production. Incorporating a guidance system developed by the Sperry Gyroscope Company, the Sparrow airframe is made by Douglas Aircraft, who also built the F3D-2 Skynight, twin-jet night-fighter, here seen with four Sparrows under the wings.

Great Britain

Vickers Armstrongs Valiant. At present, much of the effort in the Weybridge main assembly shop is devoted to production of the Valiant B.1, of which a number are on super-priority order. The production rate is gradually building up, although each Valiant must require three or four times as many man-hours in building as did the Viscounts, the first of which were built in the same shop. Production Valiants are flown off the Brooklands runway—which is only 1,525 yd long—and are thereafter based at Wisley for testing. Also at Wisley is the slightly larger, black Valiant B.2. At present an experimental "one-off" machine, this aircraft was seen over North London recently, seemingly flying at full power and leaving a persistent white trail from each wing-tip.

U.S.A.

Grumman Cougar. Scheduled to join American carriers this autumn, the F9F-8 Cougar is an advanced development, with very many improvements over earlier variants. Powered by an afterburning Pratt and Whitney J48-P-8 of some 9,000 lb thrust, the F9F-8 has wings of increased chord, the extra area being a down-cambered portion added forward of the original leading edge and housing additional tankage. Other alterations include much larger wing-root fillets, a longer fuselage, and an improved clear-view canopy.

McDonnell Demon. One of five transonic all-weather fighters now being delivered to the U.S. Navy's carrier-based fighter units, the Demon is the largest and heaviest American naval fighter in production. Illustrated in our issue of February 5th, 1954, the F3H-1N is the first squadron type, with automatic radar interception equipment and an offensive armament of four 20 mm guns *and* a large number of air-to-air rockets. The enormous 59-ft fuselage houses all the combat fuel, but underwing tanks can be carried. The Demon can also be catapulted while carrying "the payload of an attack bomber," including nuclear weapons. Photo-reconnaissance, missile-launching, and other special sub-types are to go into production at St. Louis in a few months' time, the later aircraft having J57 or J71 turbojets.

France

Nord 2501. Subject of this week's three-view drawing, the Noratlas is a "Packet-like" transport, with a capacious hold equipped with large "clamshell" rear-loading doors. At least 70 are being produced in France, the construction being widely dispersed among several plants. About 20 are involved in a barter agreement with Brazil.

Italy

Fiat Trainers. From the Goblin-powered Fiat G 80-1B has been developed the G 80-3B production variant, of which a batch is under construction. There are numerous detail differences, including the addition of four tiny fences near the wing tips, eight zero-length rocket launchers under the wings and a revised nose with transparent top; equipment alterations are also extensive. The G 81 is a Ghost-powered development, and a G 82 has also been built, with a Rolls-Royce Nene and tip tanks.

NORD 2501 NORATLAS

Two 2,100 h.p. S.N.E.C.M.A.-built Bristol Hercules 739)

Span	...	...	106ft 7in
Length	...	...	71ft 8in

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

HOMEWARD JOURNEY: This impressive picture of the Rock of Gibraltar, with the Queen and the Duke of Edinburgh inspecting the Royal Air Force parade, is framed by the port Griffons and undercarriage of a Coastal Command Avro Shackleton.

Air Welcome to the Queen

THE first contact by home-based aircraft with *Britannia* after she had left Gibraltar with the Royal Family on board was made by a Shackleton of No. 42 Squadron, 30 miles due north of Cape Finisterre. It was piloted by S/L. D. H. Sutton and had on board A.V-M. T. C. Traill, A.O.C. No. 19 Group, Coastal Command. As soon as contact was established—*via* the control centre in H.M.S. *Duchess*, one of the ships escorting *Britannia*—the Group Commander sent the message "Humble duty and loyal greetings," which greeting was duly acknowledged by the Queen. Coastal Command kept patrol over the royal yacht until she was in territorial waters.

At 6.40 p.m. last Friday evening, as *Britannia* steamed off Cowes, the Fleet Air Arm staged a fly-past by five squadrons of aircraft in a single formation. The units taking part were No. 813 Squadron (Wyverns), Lt-Cdr. C. E. Price; No. 802 Squadron (Sea Hawks); Lt-Cdr. D. N. Steer; No. 804 Squadron (Sea Hawks); Lt-Cdr. E. M. Brown, O.B.E., D.S.C., A.F.C.; No. 898 Squadron (Sea Hawks), Lt-Cdr. D. C. Parker, D.S.O., D.S.C., A.F.C., and No. 890 Squadron (Sea Venoms), Lt-Cdr. A. Gordon Johnson. Immediately in the rear of the formation the Flag Officer Air (Home), Vice-Admiral Sir John Eccles, K.C.V.O., C.B., C.B.E., flew over in a Percival Prince.

Unfriendly weather, like that which caused a fly-past restriction on Coronation Day, had a marked effect on the occasion of the Queen's London homecoming on Saturday last (writes a member of *Flight*'s staff who flew with the Duxford wing). The original plan was for the Biggin Hill, Duxford and Waterbeach wings (each of 24 Meteors) to lead the fly-past in a vee formation, followed by a similar vee of Meteors (Horsham St. Faith) and Sabres (R.C.A.F. North Luffenham and R.A.F. Linton-on-Ouse), and finally by four formations each of nine Canberras (from Binbrook, Scampton and Coningsby). In the event, bad-weather plan "B" was used, whereby the wings flew in line astern, at 30-second intervals, led by W/C. D. G. Smallwood, D.S.O., M.B.E., D.F.C., and the Biggin Hill Meteors.

Leading the Duxford wing was W/C. P. R. Wickham, D.S.O., D.F.C., and the Meteor 7 containing *Flight's* representative was flown by F/O. Tony Chambers, of No. 64 Squadron. After take-off, the join-up was made at about 600ft in a wide circle to port, the attendant Meteor 8s seeming to swim up into position between the rainwashed green below and the grey cloud-base just above.

By Wratting Common, the formation of 24 was complete—the understudying "spares," still not needed, could be seen tactfully, hopefully holding position in the distance—and we fell in behind the leading wing. Behind us the following wings, if not visible, were audible over the R/T, as Bury St. Edmunds, Stowmarket and Ipswich passed below. A starboard turn at Felixstowe—"Kodak Two, Harwich, five seconds late"—and then along the coast and over the silver grey sea towards Shoeburyness. Speed was 300 kt, altitude just under 1,000ft.

Starboard again, then over Southend and the Estuary. The formation, already tight, tucked in even closer, and the squadron beetle painted on the fin of A-Able alongside crawled ominously nearer.

Ahead were the winding curves of the Thames; below, the eastern fringe of London's dockland. Small toy boats which *might* have included the royal yacht could just be glimpsed; but it was with a realization of the two completely separate sensations experienced by those who watch formation fly-pasts from below and those who fly in them that the writer primarily recalls the passing over Gallions Reach and *Britannia*. From below, a steady, inanimate, automatic pattern: from above, a slowly weaving network of essentially individual flying machines. A right bank away from the river just before St. Pauls, and the R.A.F.'s "welcome" salute was over.

A message from the Queen, subsequently received by the Secretary of State for Air, said: "Please convey my sincere congratulations to all ranks who took part in the fly-past on Saturday. My husband and I were delighted to receive this splendid welcome from the Royal Air Force as we entered the Pool of London."

Nottingham U.A.S. Dinner

A TOTAL of 2,600 flying hours during the last year was reported by the commanding officer of Nottingham University Air Squadron, S/L. R. P. Elliott, at the squadron's annual dinner, held at R.A.F. Station Newton on Friday last. Among the other activities reviewed by S/L. Elliott was the squadron's success in small-bore rifle shooting at Bisley, where the Kingsley Wood Trophy had been won for the third successive time.

Replying on behalf of the guests, Mr. B. L. Hallward, M.A., Vice-Chancellor of Nottingham University, said that the University was intending to enlarge its electrical and electronic engineering facilities: in this, close co-operation with the squadron would be valuable for, in the future, would not guided-missile electronics engineers replace "chauffeur fighter-pilots?"

A. Cdre. R. L. Kippenberger, C.B.E., A.O.C. No. 64 (Northern) Group, next proposed the health of the squadron, amusingly developing the Vice-Chancellor's future theme of "a section with a whole lot of goon-boxes in it." Replying, P/O. Ward, one of the senior cadets, told a selection of stories on topics ranging from Tiger Moths to young ladies from Wantage; and went on to demand more advanced aircraft for the squadron to fly.

ROYAL ESCORT: Photographed by "Flight's" representative (see above): Meteors of the Duxford Wing, which formed part of the escort for the Queen's arrival in London.

The lecturer.

PAST, PRESENT and FUTURE

—*of Aeronautics: Sir Roy Fedden's Comprehensive Appraisal*

TO mark the centenary of the Society of Engineers a four-day series of celebrations was held recently in London. One hundred years' development in each of four main branches of engineering—civil, mechanical, electrical and aeronautical—was described, as part of the celebrations, in papers presented by experts in these fields on May 5th. These lectures were given at the offices of the Geological Society in Burlington House, Piccadilly, and they included *A Century of Progress in Aeronautics*, by Sir A. H. Roy Fedden, M.B.E., D.Sc., M.I.Mech.E., F.R.Ae.S.*

With such a wide subject, the lecture was comprehensive in the extreme. The main body of the paper was divided into seven sections: (1) 1854 to 1904; (2) 1904 to 1954; (3) epochs in aircraft development; (4) epochs in the history of propulsion for aircraft; (5) specialist developments acquired for aviation, and their impact on other spheres of engineering; (6) the next fifty years; (7) conclusions. It is on the last two of these that this account concentrates.

Looking forward to the next fifty years, Sir Roy stated that there seemed no prospect of the hypothetical curve for aviation advancement flattening out during this period. Although considerable strides in civil flying had been made since the war, the surface of world air travel problems had still not been scratched. The first duty was to get the ordinary citizen into the air for business and pleasure travel. This was an absolute "must" if we were to remain a great nation, and it could not be put off or neglected.

Concerning trans-continental and trans-ocean long-range travel, it seemed that speeds would not exceed 600 to 650 m.p.h. for the next twenty to twenty-five years, but inside the next fifty years it was believed that we should jump right through the sonic barrier and come out on the other side. During this period, speeds would be such that airliners would take not more than 1½ to 2 hours from London to New York, and 3 to 4 hours from London to Sydney.

In the lecturer's opinion, we had arrived at the point where almost anything was possible within the next few generations provided enough money and brain power was applied. During the next 50 years, provided it had been decreed by the human mind that it was politically sound to do so, the art of flying would be developed to permit voyages beyond the atmosphere to the moon and further, if by so doing anything satisfactory to the well-being of mankind was gained.

In conclusion, the speaker affirmed that, during the last fifty years, there had been tremendous activity and endeavour in all matters relating to aviation, and there was no doubt that much progress had been made. There was no justification for complacency, however, because we had only yet barely touched the fringe of what could come in the next few generations in aviation achievement. Up to the present the greater part of all this work and effort had been concentrated chiefly on war; how much greater happiness and true advancement had been vouchsafed to mankind on account of aircraft?

Besides their military potential, which today must be faced up to as still being of prime importance, aircraft had done a great deal to date to help the lot of man in many directions, to overcome limitations, and bridge distances; and eventually, the lecturer believed, aircraft would bring everybody so close together that war would be impossible. Therefore, he was firmly convinced that we had to press on as quickly and wisely as we possibly could with regard to all matters aeronautical, bearing in mind that we were at present an impoverished nation, and unable to spend the huge amount of money that either America could, through private enterprise and free methods; or Soviet Russia could, through dictator methods and slave camps.

Sir Roy continued: "I want to close this brief aeronautical survey on a practical and constructive note which will be understandable to the engineering profession at large. Recently, there has been a great deal written and spoken about the future of this vast subject from all angles. In these conclusions, I propose to confine myself to a few practical problems of the Government and industry on a short-term basis, in order to ensure that this country maintains its proper place in the world of aviation.

"We must have available more research money than we have had in the past, but it must be distributed to those who will appreciate their responsibilities and make a worthwhile contribution to our national aviation policy.

"I count myself most fortunate, during a long engineering career in aviation, to have had so much Government money put at my disposal for the purpose of carrying out experimental work. Now that I am an interested observer of our national aviation research and development programme, I sometimes marvel at the matter-of-course way in which certain members of our aircraft industry look upon their great privileges in this respect, compared with the older traditional branches of engineering, which have to work entirely on their own. Of course, it is impossible for the money to be found by private enterprise for this most complex and ever-increasing volume of experimental work; but I cannot help saying that I consider the British aircraft industry, from long custom and usage, has tended to become pampered, and some firms look upon these sums of money almost as their right. It is most essential that when research contracts are granted a serious contribution is made to our great national needs, and I would like to make sure that this money is allocated to those who are 'on their toes' and organized to do valuable work.

"How do we stand in aviation today in this country, and how can we best help our great ally, America, to stand firm against the Soviet menace, and at the same time compete with her in fair competition in the civil airplane field?

"Quite frankly, I am of the opinion that all is not well with aircraft development in this country, and we are at the crossroads in respect to advancement, and that unless we can go more quickly and reach out into the future, with more stability than we have shown of late, our position may be serious before long.

"At present, chiefly due to the fact, I believe, that we still have that great innate ability for inventiveness and ingenious design, we lead the world on gas turbine engines, but not by a very big margin. Also, owing to the greater background and imaginative design qualities of certain of our leading motor-car firms, good roots and creative attributes have been existent in the aero-engine business for many years in this country. These qualities have, I believe, provided the necessary engineering and other hidden assets necessary to provide the very best, and therefore I am hopeful of keeping ahead on the propulsion side by straining every nerve to maintain the tempo.

"On the other hand, on the aircraft side, things are not so satisfactory and in certain classes of machine we have already been surpassed. I have already referred to the absence of certain necessary production equipment in this country for certain types of aircraft, and also have pointed out how short we are of certain necessary facilities from several aspects if it is hoped to compete truly in the future.

"Apart from these important physical aspects, what is more serious in my estimation is the fact that an unfamiliar self-satisfaction has crept into a certain section of the aircraft industry of believing that it is better situated technically than it actually is, and this often leads to an un-British spirit of self-advertisement.

"Certain of the powers-that-be, however, tend to waste time saying that additional research facilities are not needed and that we are not slower than our American friends in designing new machines and getting them into production; but I get the impression that the latter are more balanced and say a great deal less than they used to do. They still are extravagant and possibly spend more money than they need do, and they try everything once, but they are slowly but steadily drawing away from us on aircraft.

"The result of leading the world in aviation is enormous and quite unpredictable. Apart from the fact that it is vital to our very homes and livelihood, it is also capable of attracting a lot of money into the country and also brings prestige and approbation from the whole world, which is reflected in the sale of other goods down to quite a humble and household nature.

"The effects are far-reaching and influence governments, the

**Sir A. H. Roy Fedden has had a most distinguished career, mainly in the field of aero-engine design, and dating from before the First World War, when he was an executive of Brazil Straker and Co., who manufactured engines at that time. In 1920 he inaugurated engine production by the Bristol Aeroplane Co., and controlled design and development until 1942. During the Second War he was Special Technical Adviser to the Minister of Aircraft Production. A past president of the R.Ae.S., he has been awarded numerous medals by various learned societies. He is now a governor of the College of Aeronautics.*

PAST, PRESENT and FUTURE . . .

public and even the budding generation of active-minded schoolboys of all countries. The same remarks applied fifty years ago to ships and our vast naval and passenger vessel accomplishments. Then followed the prestige and publicity of twenty-five years ago, resulting from motor-cars and car racing, and now we see the all-importance and far greater influence of everything aeronautical. We shall never maintain our past prestige by overstating our case or exaggerating what we can do.

"How are we to meet these problems? They are indeed serious, and in the next five years may well become critical and cause us to drop behind, if we are not realistic and tackle our difficulties courageously. I would suggest that there are certain things we have to do to avoid this.

"We must train more first-class technicians, engineers and production men of the highest qualities to go into aviation and all the allied industries, and we must recruit a goodly leavening of them from the most fertile strata, that is, the public schools and professional middle-class families, and thus provide a nucleus of outstanding leadership. At present, with a few exceptions, successors have not been found for the outstanding vintage of people who built up the present aircraft industry of this country. I look to the College of Aeronautics at Cranfield, and its successful development and fruition as a matter of profound importance to the future of British aeronautics in this respect. The breadth and enormous scope of the technical activities required to produce a modern aircraft demands only the finest principles, and nothing but the very best will meet our needs. At present, I understand the best type of young man is not going into the aircraft industry, although it is an excellent and stimulating life with a fair reward . . .

"Another important question is that with the extremely intricate requirements which are necessary in present-day aircraft, we must have a section of the Civil Service of the highest grade which is adequately trained technically and can make proper and correct technical and engineering appraisements and look ahead on a long-term basis, and cut out the waste of money and lack of effort which is produced by playing for safety and having so many alternatives of the same type. It should be impossible to have, as we do now in the NATO countries, five jet engines of almost identical design being made all over the world. We cannot afford several bombers of the same class in series production. We want official people at the top to appreciate these problems, and be able to give the right advice. By all means let us have all the prototypes we can possibly afford, but we must have somebody with the knowledge and the courage to choose the right types for production.

"For our own safety, and to ensure our future existence, I think we shall have to have more research money than we have at present, but not necessarily the huge sums which are spent by our friends in America. I would recommend, however, that it is most important that this is wisely allocated, and 'the butter not spread too thinly' over too large a number of firms. As long as there are enough live firms with sufficient suitable men and equipment to attract Government money and provide ample competition, that is adequate.

"I still believe in the inventive genius and the ability of our engineers and scientists and, at their level, we can still lead the world; but I am apprehensive of some of the top leadership in the aircraft industry and in the government. We must have forward-looking, long-term thinking, brilliant brains, cultivated from the right stock, and with the right training to enable a comparatively small band of people to have the courage and imagination to take long enough steps forward, such as have been done in the past. This is the only hope of keeping us in the lead.

"I am not able to elaborate on this difficult but fascinating subject further, but I would submit to engineers generally, that the position in British aviation at the moment and for the next few years ahead is critical, and that we require a realistic regeneration and the dropping of this new trait of complacency, and the building up of a Government team which can insist upon a fair share of adequate aeronautical research, money being spent amongst those who deserve it and will make the best use of it."

CRANFIELD SOCIETY A.G.M.

A WIDENING of the membership of the Cranfield Society to include (as associate members) ex-members of the academic staff and ex-officers of the College of Aeronautics, in addition to former students, was approved at the Society's annual general meeting at Cranfield on May 8th.

The committee elected for the coming year comprises Lt. Cdr. A. J. Monk (chairman), Mr. J. Spillman (treasurer), Mrs. F. Dixon and Mr. K. Harris (joint secretaries), Mr. T. M. Corson and Mr. J. Lynall.

Guests of the Society at the dinner which preceded the meeting included the principal of the College, Sir Victor Goddard; Mr. R. L. Lickley, formerly head of the department of design at Cranfield and now Fairey chief engineer; and Mr. V. F. Knight, formerly registrar of the College, and now with English Electric.

WALLACE WILLIAM GREENFIELD

FROM Blackburn and General Aircraft, Ltd., we learn with regret of the sudden death, following a collapse, of Mr. W. W. Greenfield, F.R.Ae.S., M.I.Mech.E., assistant chief designer in charge of their London drawing-office.

Mr. Greenfield began his aviation career in 1924 as a Blackburn apprentice at Brough and subsequently became a section leader in the design office. He transferred to the stress department and, later, was responsible for the first aeronautical engineering course at the Hull Technical College.

In May 1936 he joined F. Hill and Sons, of Manchester, where he was chief engineer in control of the design and manufacture of their light aircraft. In 1937 he went to the Fairey Aviation Co. as assistant designer, and in 1943 was appointed design engineer for helicopters. In 1949 he became experimental engineer responsible for helicopter design and devlopment. In the following year he went to Boulton Paul Aircraft, Ltd., in June 1950 as manager in control of experimental work, and three years later joined Blackburn and General Aircraft.

ABILITY REWARDED

TWO happier items of news from Blackburn and General Aircraft concern, first, a well-earned retirement and, secondly, a younger man's achievement.

The retirement is that of Mr. "Wilf" Barnard, senior lecturer in aeronautics at Hull Technical College, who has been training technicians for the past 20 years. He had previously been with Blackburns, having joined their drawing office in 1925 after spending his early years with the engineering firm of Dorman Long. Donations towards a retirement presentation came from ex-students at almost every aircraft factory in Britain.

At a dinner at the Flying Club at Brough, Mr. C. B. Fenton, Blackburn's assistant chief designer, presented a wrist watch on behalf of Mr. Barnard's ex-students and colleagues. Another presentation took place after a luncheon with the Blackburn directors on the following day, when a radio set was presented by Mr. Eric Turner, managing director, on behalf of the company.

The younger man is 26-year-old Mr. Antony Barber, an assistant in the mechanical test laboratory at Brough. He has learned that he is one of 26 successful candidates (out of a field of 244) who have been awarded King George VI Memorial Fellowships to Columbia University, New York City, for the year 1954-55.

"C.B." AGAINST FIRES

AT Bovingdon Airfield last week a demonstration was given of a fire-extinguishing medium which is being supplied for use on U.S.A.F. crash tenders throughout Europe and which, it is understood, the Air Ministry has recommended after tests as an addition to the equipment of the latest type of R.A.F. foam fire-tenders. The medium is chlorobromomethane, and the suppliers are the General Fire Appliance Co., Ltd., of London. An account of the demonstration will be given in our next issue.

FACSIMILE: Though there is a growing tendency towards complete verisimilitude in cabin mock-ups, this H.P.R.3 layout by Handley Page (Reading), Ltd., looks so convincing as to make the term "mock-up" sound derogatory. The H.P.R.3 is among the promising Dakota replacements listed on page 674.

ANTI-SUBMARINE

Powered by an Armstrong Siddeley "Double Mamba"

FAIREY GANNET

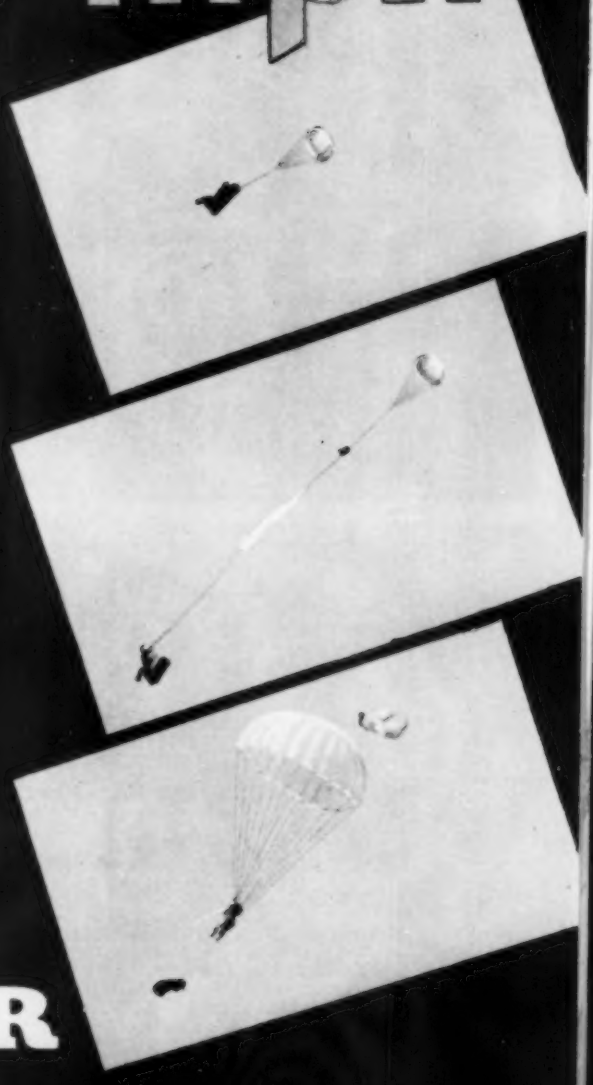
For service in the Royal Navy—Fairey Gannets will operate from Fleet and Light Fleet Carriers. The Gannet is the latest specialised anti-submarine aircraft produced in Britain.

FAIREY AVIATION

THE FAIREY AVIATION COMPANY LIMITED · HAYES · MIDDLESEX

at low altitudes each second is vital

150 ft. 600 mph



On the 17th March, 1954, an ejection in straight level flight was made from a Meteor 7 aircraft with the Martin-Baker Patent fully Automatic Ejection Seat.

- The speed 600 m.p.h., the height only 150 feet.
- One second after ejection, drogue developed holding seat steady and slowing it down.
- Three seconds after ejection, parachute fully developed with 80 feet in hand.

Patented in the principal countries of the world and certain patents pending.

MARTIN–BAKER

AIRCRAFT COMPANY LIMITED · HIGHER DENHAM · NEAR UXBRIDGE · MIDDLESEX

EACH post-war year has seen fresh advances in the design, development and operation of transport aircraft, and 1954 is no exception. Britain's aircraft of the year is the medium-stage Viscount, first turboprop airliner, now in its second twelvemonth of revenue service and bearing the colours of Air France, Aer Lingus and B.E.A. The progress of pure-jet passenger travel is temporarily halted, but interest in jet airliners reaches a peak as, on opposite sides of the ocean they are designed to cross, two competitive prototypes emerge from the factories of de Havilland and Boeing.

Britannia, first and only long-haul turboprop transport, nears her certification and operational debut with B.O.A.C. Meanwhile, America's West Coast remains the main supply-source of big airliners. Within the U.S.A., the DC-7 and Super Constellation provide the coast-to-coast passenger with his first non-stop, 300-m.p.h. service. Elsewhere, the new Lockheed mainliner enables Commonwealth and foreign operators to improve schedules and comfort.

Small-scale helicopter services are in daily operation. Bristol, Fairey, Piasecki and Sikorsky are prominent as potential suppliers for this new short-haul market.

TRANSPORT AIRCRAFT • 1954

Over 70,000 lb

AVRO TUDOR • "An aircraft with a relatively low capital value which can operate more economically than the York and has a performance comparable with that of more modern aeroplanes such as the Argonaut and Hermes." This realistic assessment of the Tudor has been applied by Mr. F. A. Laker, managing director of Air Charter, Ltd., whose recent actions have proved that this robust and capacious transport can still offer a useful working life. His company has bought the entire ex-M.T.C.A. stock of ten Tudors and is already operating five on both long and short hauls, carrying passengers and freight. Extensive modifications, including complete deletion of the pressurization system, were made before the Tudors' return to service.

Tudor IVB (four Merlin 623, total 7,040 h.p.).—Span, 120ft; length, 85ft 3in; take-off weight, 82,000 lb; wing loading, 57 lb/sq ft; take-off distance, 5,000ft; passenger capacity, 42; typical performance, 200 m.p.h. for 2,500 miles at 8,000ft with 12,000 lb payload.

BLACKBURN UNIVERSAL • The fact that the R.A.F. has ordered a number of Beverleys, production of which is under way at Brough, greatly increases the makers' prospects of selling the civil version of this 61-ton multi-purpose transport. To be known as the Universal, it will be capable of carrying more passengers than any airliner yet introduced—132 in high-density seating. The tail boom alone has more accommodation than the average twin-engined transport, being capable of seating 42 people. As a freighter, the Universal can carry a useful load of 22 tons—mostly in the rear-loaded main hold, which is 10ft wide and high and 40ft long.

A scheme involving permanent "airlifting" for both agricultural and industrial purposes by a small fleet of Beverleys is being advocated for Australia. One of the points made to support this contention is the estimate that a single Universal could move a trainload of fat cattle over a distance of 200 air miles in one day.

Although the standard power unit for the Beverley is the Centaurus, design studies have been made for an improved Universal with Wright Turbo-Compounds. The longer-term proposal for using Napier Nomad compound diesels might well produce an unmatched combination of lifting capacity and operating economy.

Universal (four Centaurus 173, total 11,400 h.p.).—Span, 162ft; length, 99ft 2in; take-off weight, 135,000 lb; wing loading, 46.4 lb/sq ft; take-off distance, 3,540ft; passenger capacity, 132; typical performance, 175 m.p.h. for 200 miles at 8,000ft with 46,300 lb payload.

BOEING 377 STRATOCRUISER • Although civil production ceased with the completion of B.O.A.C.'s tenth Stratocruiser in 1949, this double-deck giant retains a unique position on the Blue Riband international routes. With a take-off weight of 145,800 lb, it is still the heaviest aircraft in scheduled airline service, and many experienced travellers still regard it as the most comfortable. As employed on the renowned "Monarch" service, the Stratocruiser carries 52 passengers in great comfort; sleeping berths are available for a £12 10s surcharge. On P.A.A.'s transatlantic Stratocruisers, payment of $125 (£44 12s) admits the passenger to a two-berth "President Stateroom" which, together with the competitive "Golden Parisien" service offered by Air

Transport Aircraft • 1954...
Over 70,000 lb (contd.)

France, probably represents the present-day peak of luxury in inter-continental air travel. The Stratocruiser is smoother and quieter than most piston-engined transports, and has the added attraction of a lower-deck lounge connected to the main cabin by a spiral staircase.

Fifty-three of the big Boeings are in service today—25 with P.A.A., 10 each with B.O.A.C. and Northwest Airlines and six with United Air Lines. A military version, the C-97, is still in production, and more than 500 have already been built.

Stratocruiser (four Wasp Major, total 14,000 h.p.).—Span, 141ft 3in; length, 110ft 4in; take-off weight, 145,800 lb; wing loading, 82.4 lb/sq ft; take-off distance, 7,075ft; passenger capacity, 50-80; typical performance, 300 m.p.h. for 3,000 miles at 25,000ft with 24,500 lb payload.

Avro Tudor (Air Charter).

Blackburn Beverley/Universal prototype.

Breguet Deux-Ponts Provence (Air France).

Boeing Stratoliner.

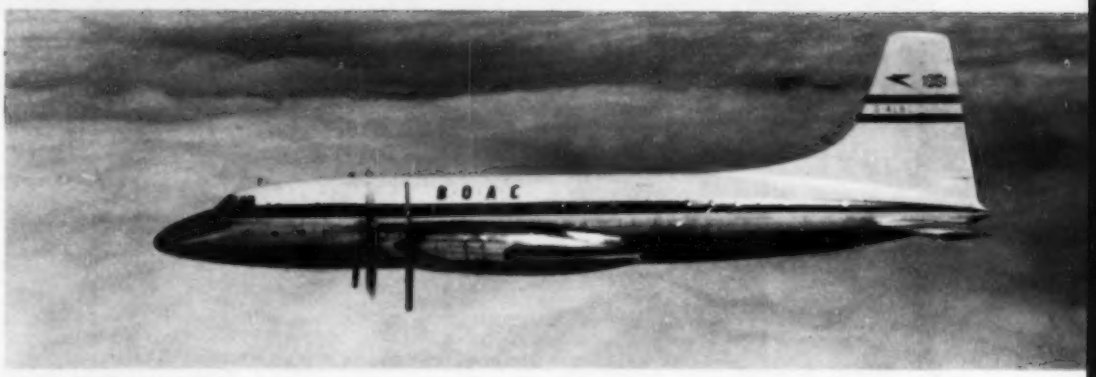
BOEING 367-80 STRATOLINER • The Boeing Airplane Company has spent no less than £5,350,000 on the design, development and construction of the jet transport prototype due to fly next month. Popularly known as the "707," the aircraft has the company designation 367-80 and is a multi-purpose machine intended for demonstration in three separate rôles to three separate customers. The basic design can be adapted as (a) a military tanker for the U.S.A.F. Strategic Air Command; (b) a trooper/freighter for M.A.T.S., which, incidentally, is the largest air-transport organization in the world; and (c) a long- and medium-range commercial airliner.

The civil model, with which we are here concerned, will bear the revived name of Stratoliner: its predecessor, still in isolated airline service, was the first pressurized airliner in the world. Boeing claim that the new Stratoliner, carrying 80 to 130 passengers and cruising at 550 m.p.h. will "out-produce the best of piston-engined airliners, in terms of work capacity, by more than two to one."

In U.S. domestic service it should be capable of reducing the coast-to-coast journey time from seven to five hours, and as a transatlantic mainliner it would fly direct from New York to London "in less than seven hours." Superficially the Stratoliner contrasts with the Comet 3 in having separate, pod installations for its four jet engines—J57s of 10,000 lb thrust. It is also a larger machine, weighing up to 190,000 lb compared with 145,000 lb; both span and length are greater by 17ft. The jet Stratoliner promises to be an impressive performer and there is a deal of sober confidence behind the manufacturer's declared intention to "market a jet transport which will successfully compete with all comers in 1956."

Stratoliner (four J57, total 40,000 lb s.t.).—Span, 130ft; length, 128ft; take-off weight, 190,000 lb; wing loading, 79 lb/sq ft; take-off distance, 7,700ft; passenger capacity, 80-130; typical performance, 550 m.p.h. for 4,000 miles at 35,000ft with 16,000 lb payload.

Boeing Stratocruiser (B.O.A.C.).



Bristol Britannia 100 prototype.

Canadair Argonaut (B.O.A.C.).

BREGUET PROVENCE • Since March last year the appellation "Breguet" has been appearing regularly in the Air France timetables for domestic and North African routes. It refers to the mighty 76-3 Deux Ponts, or—to use the name favoured by its operator—Provence. And occasionally, when traffic is at a peak, the Breguet puts in an appearance on the London-Paris route, for its two decks can carry up to 107 passengers—more than twice as many as the normal load for British and French airliners connecting their respective capital cities. Large folding doors give access to the lower part of the rear fuselage, and both decks can be used for freight. Normally, however, the top storey is fitted with 59 permanent tourist-class seats, the 48 second-class seats on the lower deck being quickly removable. The volume of the lower cabin—2,285 cu ft—is such that the entire payload of 16 tons can, if necessary, be carried in this compartment. Notwithstanding its great bulk, the Provence cruises at over 220 m.p.h. on the power of four Double Wasp CA18s.

Deux-Ponts (four R-2800 CA18, total 9,600 h.p.).—Span, 141ft; length 94ft 11in; take-off weight, 110,231 lb; wing loading, 42 lb/sq ft; take-off distance, 5,550ft; passenger capacity, 107; typical performance, 223 m.p.h. for 870 miles at 8,000ft with 24,250 lb payload.

BRISTOL BRITANNIA • There are firm or provisional orders for a total of 41 Britannias by two named airlines—B.O.A.C. and Qantas. In addition, it has been announced that seven other operators have entered negotiations for 51 more of these long-range turboprop airliners. Remembering the excellent competition offered by less advanced but better-known machines, such as the DC-7 and the Super Constellation, this can be regarded as a promising start for a completely new airframe/power-unit combination. The prototype Britannia first flew in September 1952 and subsequent progress has been good.

The first production Britannia 100 for B.O.A.C. will emerge shortly from the Filton assembly hall and it is hoped that, after development flying and crew training, a fleet of nine or ten will be ready for service next year. These will be Britannia Mk 100s; later versions for B.O.A.C. and other airlines will be "stretched" by 10ft 3in. An idea of the Britannia's performance on a typical B.O.A.C. route was given by an analysis published by Bristol's last December. This showed that the lengthened Mk 300 could carry a full capacity payload of 104 tourist passengers plus baggage from London to Tokyo in 31 hours elapsed time, covering this 9,928-mile route in five stages. The long-range version, for which figures are quoted below, will have a still-air range of no less than 6,200 miles on its full tankage of 8,300 gallons, carrying a 16,000 lb payload.

The precise date of the Britannia's introduction to revenue service depends upon the time taken in obtaining a Certificate of Airworthiness. The original target date of June 1955 may be put back by some three months by the loss, last February, of the second prototype Britannia which forced-landed after a fire had developed in one engine nacelle during a test flight.

Britannia 300 (four Proteus 755, total 16,600 e.h.p.).—Span, 140ft; length, 124ft 3in; take-off weight 165,000 lb; wing loading, 80.4 lb/sq ft; take-off distance, 5,500ft; passenger capacity, 58-92; cruising speed, 345-395 m.p.h.; still-air range with capacity payload (30,000 lb), 4,500 miles.

De Havilland Comet 3 prototype.

De Havilland Comet 2 (B.O.A.C.).

Transport Aircraft • 1954 . . .
Over 70,000 lb (cont.)

CANADAIR IV • Possibly because of its hybrid origin, the Canadair IV has never fully achieved the fame it deserves. It is not generally appreciated, for example, that it is the backbone of the two largest long-haul international airlines in the British Commonwealth—B.O.A.C. and T.C.A. In B.O.A.C. service the type is known as the Argonaut; the Corporation's first-class lay-out is for 40 passengers and tourist versions carry 56. Like the British airline, T.C.A. operate 22 Canadairs, known as North Stars, which carry 48 passengers in domestic service and 40 on transatlantic routes.

Dimensionally, and to some extent visually, the Canadair resembles the DC-4, but it does in fact embody a number of features developed for the DC-6, including stronger wings and undercarriage and a modified rear fuselage. Unlike the DC-4, it has a pressurized cabin, and the engines are British Rolls-Royce Merlin 724s.

Canadair IV (four Merlin 724, total 7,040 h.p.).—Span, 117ft 6in; length, 93ft 7.5in; take-off weight 82,000 lb; wing loading, 55.1 lb-sq ft; take-off distance, 5,200ft; passenger capacity, 40-56; typical performance, 270 m.p.h. for 2,600 miles at 18,000ft with 12,000 lb payload.

DE HAVILLAND COMET 1 AND 2 • At the time of writing, the lustre associated with the name of the world's first jet airliner has been dimmed—only temporarily, it is hoped—by the series of three unexplained accidents which resulted in withdrawal of Certificates of Airworthiness for Comets in airline service. The official grounding order applies to B.O.A.C.'s Comet 1s and to Series 1As of U.A.T. and Air France. The Comet 1 is built to carry 36-40 passengers and was used on international routes in stages of up to 1,300 miles. The normal operating height is 36-40,000ft and the four Ghost turbines give a cruising speed of up to 490 m.p.h.

The Comet 2 differs essentially in being powered by more efficient Avon 503 axial-flow turbojets of much greater thrust, and in having a longer fuselage, accommodating up to 44 passengers. Its performance, in terms of range, is greatly improved: 2,200 miles is a conservative estimate of the maximum stage-length with full load. More than 30 Series 2s are on order.

Comet 2 (four Avon, total 28,600 lb s.t.).—Span, 115ft; length, 96ft; take-off weight, 115,000 lb; wing loading, 59 lb/sq ft; take-off distance, 7,000ft; passenger capacity, 44; typical performance, 500 m.p.h. for 2,200 miles at 40,000ft with 13,450 lb payload.

Douglas DC-6 (S.A.S.).

Douglas DC-6A (American Airlines).

DE HAVILLAND COMET 3 • The prototype Comet 3 ordered by the Ministry of Supply is fast approaching completion. Earlier this month it was wheeled out of its assembly hangar at Hatfield for initial running of the four Avon turbojets (new civil versions developing well over 9,000 lb thrust). B.O.A.C.'s first order for Comet 3s is intended to provide the airline with a nucleus of five aircraft for high-speed Atlantic services. Pan American have ordered three more and Air India International hope to take delivery of three in 1957. Options exist for further Series 3s.

While retaining the basic systems and structural features of the Comet 2, the new version is 15ft longer in the fuselage, providing additional seating capacity for a total of 58 first-class passengers or 78 tourist. By means of nacelle-like external tanks, fuel capacity is raised from 6,900 to 8,050 Imperial gallons; the extra fuel capacity and improved engine economy raise the practical stage-length by about 25 per cent to 2,700 miles. The Comet 3's cruising speed (500 m.p.h.) and improved payload result in an exceptional work capacity; this is graphically illustrated by the de Havilland statement that "assuming an annual utilization of 3,000 hours, a fleet of five Series 3 Comets will be able to transport more than 97,000 passengers between Europe and the United States in a year, which is more than would be carried by the Queen Mary in the 46 single crossings which the liner normally makes in a 12 month period."

Comet 3 (four Avon, total 40,000 lb s.t.).—Span, 115ft; length, 111ft 6in; take-off weight, 145,000 lb; wing loading, 72 lb/sq ft; take-off distance, 7,000ft; passenger capacity, 58-78; typical performance, 500 m.p.h. for 2,700 miles at 40,000ft with 17,500 lb payload.

DOUGLAS DC-6 • Development of the renowned DC-6 series of transports has been continuous for the past nine years and some 400 have been delivered to the airlines. First used on American domestic services in 1947, the original DC-6 was basically a much modified DC-4, with improved structure, more powerful engines, pressure cabin, improved interior design and a 7ft 8in increase in fuselage length. The addition of a further 5ft produced, in 1949, the DC-6A Liftmaster, an all-freight machine used by American Airlines and K.L.M. and due for early delivery to Sabena and P.A.A. This aircraft in its turn was developed for passenger work as the DC-6B, of which about 150 have been delivered to 17 different operators. Yet another version, which has not so far been taken up by the airline industry, is the DC-6C, a dual-rôle model combining the large cargo doors and strengthened floor of the -6A with seating capacity for up to 76 passengers. It can be quickly converted from the one version to the other and has a movable bulkhead to separate the cargo and passengers when both classes of payload are carried. The all-freight Liftmaster carries up to 15 tons of cargo, or about 12 tons on transatlantic routes, and the "B" high-density version accommodates 87 people. Specifications vary throughout the DC-6 series and the data below are for one of the most up-to-date versions, as supplied to P.A.A.

DC-6B (four R-2800 CB17, total 10,000 h.p.).—Span, 117ft 6in; length, 105ft 7in; take-off weight, 107,000 lb; wing loading, 73.1 lb/sq ft; take-off distance, 5,998ft; passenger capacity, 56-82; typical performance, 313 m.p.h. for 2,900 miles at 22,500ft with 14,000 lb payload.

Handley Page Hermes IV (Airwork).

DOUGLAS DC-7 • Latest, fastest and most capacious of long-range transports to enter service, the DC-7 represents a still further improvement of the long-established DC-6 series. It was first operated late in 1953 by American Airlines, who were originally responsible, two years earlier, for suggesting to Douglas the formula which produced the DC-7. The idea was to increase the performance of the DC-6B by substituting 3,250 h.p. Wright Turbo-Compound engines for the 2,500 h.p. Pratt and Whitney R-2800s. As a result, gross weight has been increased from 107,000 to 122,000 lb; the fuselage length is up by 3ft 4in and cruising speed has been boosted from 315 m.p.h. to a maximum of 360 m.p.h. at 25,000ft. Other improvements include a freon air-conditioning system, extensive use of titanium sheet in the engine nacelles and incorporation of a main undercarriage which can be extended as a speed brake at indicated air-speeds of up to 300 m.p.h.

Seven airlines have ordered a total of 88 DC-7s, of which more than a third have been delivered at the time of writing. Douglas quote late 1955 as the delivery date for a DC-7 ordered today. The price of one aircraft with spares is more than $2m —about four times the cost of the DC-4.

DC-7 (four R-3350 Turbo-Compound, total 13,000 h.p.).—Span, 117ft 6in; length, 108ft 11in; take-off weight, 122,000 lb; wing loading, 84 lb/sq ft; take-off distance, 5,870ft; passenger capacity, 64-95; typical performance, 353 m.p.h. for 3,050 miles at 23,500ft with 17,225 lb payload.

Douglas DC-7 (United Air Lines).

Douglas DC-6B (National Airlines).

Lockheed Constellation with Speedpak (Eastern Air Lines).

Transport Aircraft • 1954...

Lockheed Super Constellation (Pakistan International Airlines).

Over 70,000 lb (cont.)

HANDLEY PAGE HERMES IV • First post-war pressurized airliner to become available in numbers to Britain's independent operators, the Hermes was last year withdrawn from Service on B.O.A.C.'s African routes. Nineteen aircraft are being sold by the Corporation, which has announced that ten will go to Skyways, six to the Britavia group and three to Airwork (who already operate three). In luxury form the Hermes takes 40 passengers, although most have been modified to carry 56.

Hermes IVA (four Hercules 773, total 8,400 h.p.).—Span, 113ft; length, 96ft 10in; take-off weight, 86,000 lb; wing loading, 61 lb/sq ft; take-off distance, 5,120ft; passenger capacity, 40-60; typical performance, 230 m.p.h. for 1,600 miles at 13,000ft with 15,000 lb payload.

LOCKHEED CONSTELLATION • Although it first flew as a military prototype (in January 1943) the Constellation grew from a specification given to Lockheed in 1939 by Transcontinental and Western Airlines, predecessor of T.W.A. That specification envisaged an airliner capable of flying 3,500 miles at 250-300 m.p.h. with a 6,000 lb payload. The result was one of the most useful, shapely and (thanks partly to a superb public-relations campaign) most famous transport aircraft the world has seen.

T.W.A. received their first 15 "Connies" in October 1945 and have subsequently built up the largest fleet of this type in the world, having now in service or on order a total of 98 (including Super Constellations).

There are several versions of the Constellation, ranging from Model 49D, the basic conversion of the U.S.A.F. C-69 military transport, with a take-off weight of 96,000 lb, to the 749A (107,000 lb). It shares with the DC-6 the honour of carrying the bulk of international air traffic. There are today about 190 Constellations in service with 16 different operators. Many of these aircraft have been converted from luxury models, seating about 40 passengers, to tourist-class 60-seaters.

Use of the Speedpak, a boat-shaped pannier carried beneath the fuselage, enables the Constellation to carry an extra 5,200 lb of cargo with a range penalty of 4 per cent. The cruising speed at constant engine b.h.p. when using the Speedpak is reduced by only 8 m.p.h.

Constellation 749A (four Wright C18-BD1, total 10,000 h.p.).—Span, 123ft; length, 95ft 2in; take-off weight 107,000 lb; wing loading, 64.8 lb/sq ft; take-off distance, 5,400ft; passenger capacity, 49-57; typical performance, 270 m.p.h. for 3,000 miles at 23,000ft with 16,000 lb payload.

LOCKHEED L.1049 SUPER CONSTELLATION • "Stretch" is exemplified to the *n*th degree by today's Super Constellation, which is 84 per cent heavier than the machine envisaged in the original T.W.A. specification and 54 per cent heavier than the first production model. Power has increased by 48 per cent, and the fuselage length has been extended by 18.4ft, providing capacity for as many as 99 tourist passengers.

There are four basic civil versions of the Super Constellation, beginning with the original L.1049 introduced to American domestic service in 1952 by T.W.A. and Eastern Air Lines. Although longer than the Model 749 and incorporating some 550 design improvements, this employs Wright C18-CA1 engines delivering 2,700 b.h.p. each—a total increase of only 800 b.h.p. on the total power of the four BD1s of its predecessor.

The next step was to install 3,250 h.p. Wright Turbo-Compound engines which, by recovering power from the exhaust gases, offer a potential 20 per cent decrease in specific fuel consumption at the best cruising setting. The first "Super" to utilize these excellent power-units is the 1049B cargo version, five of which have been ordered by Seaboard and Western Airlines for trans-atlantic service. Each of these aircraft will be capable of lifting nearly 18 tons from Gander to Shannon. Next comes the 1049C passenger version, with a multi-compartment interior designed by Henry Dreyfuss of New York but in other respects identical to the freighter. Both versions have a take-off weight of 130,000 lb. A later passenger model, the 1049E, is permitted to take-off at 133,000 lb and (subject to undercarriage "beefing") is structurally capable of operating at no less than 150,000 lb. This model has been produced to allow for possible conversion to turboprop power at some future date; it has a freighting counterpart in the 1249A.

Preliminary data only are available for the 1249B, which will have Pratt and Whitney T34 turboprops of some 5,700 h.p. each. Its maximum cruising speed (85 per cent of normal rated power) of 415 m.p.h. compares with 339 m.p.h. for the 1049C, but the estimated still-air range drops from 4,940 to 3,450 miles.

Actual cruising speed maintained by the Turbo-Compound Super Constellations in airline service is normally about 300

Saunders-Roe Princess.

Short Solent (Aquila Airways).

S.N.C.A.S.E. Caravelle.

Vickers V.C.7.

m.p.h., compared with 265 m.p.h. for the Model 749. These figures are not quite as impressive as those normally issued for publicity purposes; nevertheless, on the basis of both performance and popularity the Super Constellation must be regarded as the foremost transport in international airline service at this time.

Super Constellation L.1049C (four Wright TC18-DA1, total 13,000 h.p.).—Span, 123ft; length, 113ft 8in; take-off weight 130,000 lb; wing loading, 80 lb/sq ft; take-off distance, 5,780ft; passenger capacity, 63-99; typical performance, 300 m.p.h. for 4,000 miles at 23,000ft with 20,000 lb payload.

SHORT SOLENT • Although marine aircraft play but a small part in modern civil aviation, the Solent takes its place in this survey as a representative of the renowned line of Short flying-boats. Two of these luxurious aircraft, fitted out as 42-seaters, are used on the famous Aquila Airways service to Madeira, and also on this company's new service to Capri. Another has been bought by the famous Australian pioneer airman Captain P. G. Taylor for an ambitious programme of private air cruises around the Pacific islands.

Solent 2 (four Hercules 637, total 6,760 h.p.).—Span, 112ft 9in; length, 88ft 7in; take-off weight, 78,000 lb; wing loading, 46.2 lb/sq ft; take-off distance, 5,900ft; passenger capacity, 42-60; typical performance, 200 m.p.h. for 1,200 miles at 8,000ft with 15,000 lb payload.

S.N.C.A.S.E. 210 CARAVELLE • Designed to meet a French Government requirement for a modern medium-range airliner, the Caravelle promises to have many unique features. In the first place it is unusual among pure-jet civil designs in having only two power-units (9,000/10,000 lb-thrust Avons) and also in the mode of their installation—in pods, at the sides of the rear fuselage. Several advantages are claimed from the viewpoints of aerodynamics, safety and passenger comfort. There is an intentional similarity between the Caravelle's nose and that of the Comet: the French jet transport is, in fact, designed to utilize the complete nose section and control cabin of its British predecessor. Two prototypes are under construction.

Caravelle (two Avons, 18,000 lb thrust).—Span, 113ft; length, 103ft; take-off weight, 84,500 lb; wing loading, 54 lb/sq ft; take-off distance, 6,000ft; passenger capacity, 70-90; typical performance, 470 m.p.h. for 1,550 miles at 36,000ft with 15,400 lb payload.

SAUNDERS-ROE PRINCESS • Three Princess flying-boats have been completed at an estimated total cost of more than £10m. One is being test-flown and her sister ships are in storage, pending a decision on the future of these majestic craft. Last November two operators showed interest in the Princess: Aquila Airways bid over £1m for the Princesses and B.O.A.C. announced a proposal to operate them on world-wide routes "when the hull has been fitted with engines that will give a competitive commercial performance." If operated commercially the ten early Proteus 2s would be replaced by six more powerful units. Use of Proteus 3s, as in production for the Britannia, might reduce the effective range, however, to less than 2,000 miles. An alternative, longer-term plan would be to fit the big boats with a still later and more powerful Bristol gas turbine now under development.

Princess (ten Proteus 600, total 28,200 h.p.).—Span, 219ft 6in; length, 148ft; take-off weight, 315,000 lb; wing loading, 65 lb/sq ft; passenger capacity, 100; typical performance, 355 m.p.h. for 4,200 miles at 35,000ft with 40,000 lb payload.

VICKERS V.C.7 • "At the end of a quiet country lane in Surrey lies a squat, rather unpretentious aircraft hangar. Inside, behind a wooden screen, Britain's largest jet transport is abuilding and already the fuselage is taking shape, with its portholes peering through a lattice of frames and stringers. . . . This is a big aeroplane, well over 200,000 lb, and it is reckoned that it will carry 120 passengers in first-class comfort over the North Atlantic from London to New York in a matter of seven hours or less. It will fly next year."

This reference to the V.C.7 is quoted from the April issue of *The Log*, the journal of the British Air Line Pilots Association. It says virtually all that can be said about this great project at present, for the prototype actually under construction is the secret Vickers 1000 jet transport for the R.A.F., and the V.C.7 will be its civil derivative. Scale models show that, although bearing a superficial resemblance to the Valiant jet bomber, the "1000" will in fact be a much bigger aircraft. The four Rolls-Royce Conway by-pass turbojets, buried deep in the deep-chord, Swift-like wing, are expected to confer fuel economy of the order now associated with the most advanced turboprops.

V.C.7 (four Conway).—Span, 140ft; length, 146ft.

Airspeed Ambassador (B.E.A.)

Avro York (Skyways).

Transport Aircraft • 1954 . . . 12,500—70,000 lb

AIRSPEED AMBASSADOR • Despite the difficulties associated with being the sole operator of a complex modern aircraft, British European Airways have turned their Elizabethan (as the Corporation styles the Ambassador, which is built by de Havillands' Airspeed Division) into an outstanding medium-range transport. Its roomy 47-seat fuselage is extremely popular with passengers and in this respect the Elizabethan's high wing probably gives it an "edge" over all its competitors.

The chief executive of B.E.A. reports that on the airline's shorter routes—the average international stage is 313 miles—its Elizabethans are the most economical of the entire fleet. Twenty of these aircraft are in regular service on both domestic and overseas routes; a 21st is being used by the Bristol Aeroplane Co. as a test-bed for the Proteus turboprop.

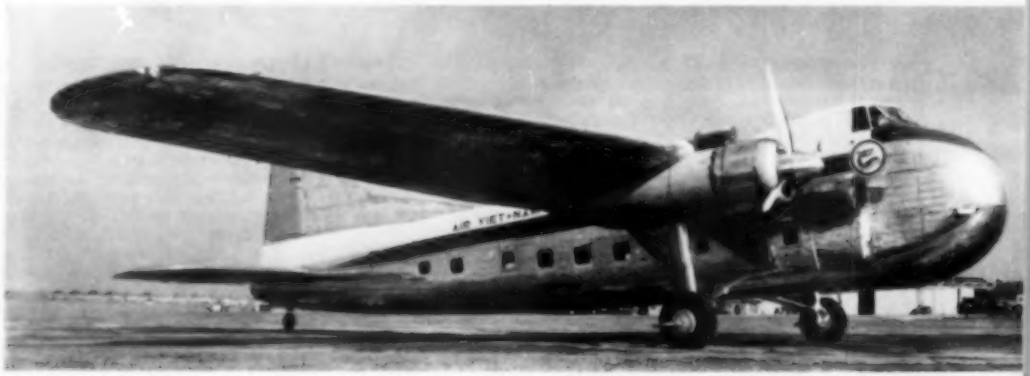
Ambassador (two Centaurus 661, total 5,200 h.p.).—Span, 115ft; length, 82ft; take-off weight, 52,500 lb; wing loading, 43.7 lb/sq ft; take-off distance, 4,720ft; passenger capacity, 40-47; typical performance, 240 m.p.h. for 800 miles at 15,000ft with 11,000 lb payload.

AVRO YORK • Although unpressurized and noisy, the veteran York is both roomy and reliable, and carries payloads of up to seven tons on medium-stage routes. As it is almost unique in being a four-engined transport obtainable at a relatively low cost (£20,000-£25,000) it has become standard equipment with several British independent airlines. About 30 are still in service for trooping, scheduled services and freighting, but their replacement by more modern types is not likely to be delayed by more than a year or two.

York (four Merlin 502, total 6,440 h.p.).—Span, 102ft; length, 78ft; take-off weight, 68,000 lb; wing loading, 52.4 lb/sq ft; take-off distance, 6,820ft; passenger capacity, 45; typical performance, 210 m.p.h. for 1,300 miles at 8,000ft with 11,000 lb payload.

BRISTOL 170 • In steady production throughout the post-war period, the Bristol 170 is now recognized as the world's outstanding short-range cargo aircraft. Over 100 Type 170s of various marks have been delivered and are in service in practically every corner of the world. As a freighter, the Mk 31 lifts a payload of nearly six tons, and the passenger version carries 44 people. Operators of this model include Trans-Canada Airlines, Aer Lingus, Air Charter and Straits Air Freight Express, Ltd. This latter company reported recently that one of its aircraft carried more than 110 tons between the North and South Islands of New Zealand in a single day.

The 16 Type 170s operated by Silver City Airways comprise the largest fleet of Freighters in service with any airline, and includes nine "stretched" Mk 32 Super-freighters each capable of carrying three cars. Last year the company carried nearly 100,000 passengers and 40,000 vehicles between England and France. Silver City's 170s averaged 3,200 landings and take-offs each during 1953—an intensity of operation which is believed to constitute a record for any type of large commercial aircraft.



Bristol 170 (Air Viet Nam).

Bristol 173.

Bristol 170 Mk 31E (two Hercules 734, total power 3,900 h.p.).—Span, 108ft; length, 68ft 4in; take-off weight, 44,000 lb; wing loading, 29.5 lb/sq ft; take-off distance, 3,675ft; passenger capacity, 40; typical performance, 166 m.p.h. for 850 miles at 5,000ft with 10,000 lb payload.

BRISTOL 173 ROTORCOACH • Several important "firsts" are associated with the name Rotorcoach, which has been chosen for the developed Mk 3 version of Bristol's Type 173 helicopter. The 173 was the first helicopter designed for safe flight with one engine shut down, and it is likely to be the first rotary-winged "twin" to enter airline service. Three Mk 3s have been ordered for British European Airways. Powered by two 850 h.p. Alvis Leonides Majors, the Rotorcoach will carry 16 passengers at a cruising speed of 138 m.p.h.; the existing Mk 2 (illustrated) has 545 h.p. Leonides, and carries up to 13.

Rotorcoach (two Leonides Major, total 1,700 h.p.).—Span (rear wing), 33ft; rotor diameter, 48ft 7in; length, 54ft 2in; take-off weight, 14,500 lb; disc loading at 13,500 lb, 3.63 lb/sq ft; cruising speed, 138 m.p.h.; still-air range, 214 miles.

Convair-liner 340 (K.L.M.).

CONVAIR 240 AND 340 • The Convair-liner will be remembered as the outstanding medium-range transport of the late forties and early fifties. More than 350 have been sold to 35 different operators, including a scattering of executive-transport versions. The most important differences between the two models (which, incidentally, have been sold in approximately equal numbers) are the 340's fuselage stretch of 4.5ft, enabling standard passenger capacity to be increased from 40 to 44, and its extended wings containing 350 more gallons of fuel for extended range. Provision has been made for fitting both types with turboprops when sufficiently developed units are available.

The results of a 1951 series of tests with the Turboliner, a Model 240 equipped with 2,600 h.p. Allison turboprops, were not encouraging. However, a military version of the 340, designated YC-131C, has now been fitted with new Allison YT56 turboprops and was due to have begun flight trials at the time of writing.

After near-monopolizing the medium-range market for many years, Convair are beginning to lose ground to Vickers-Armstrongs. Last December one of the American company's sales executives was quoted as saying after an overseas tour: "Everywhere I went the airline operators were talking about the Viscount."

CV-340 (two R-2800 CB16, total 4,800 h.p.).—Span, 105ft 4in; length, 79ft 2in; take-off weight 47,000 lb; wing loading, 50.8 lb/sq ft; take-off distance, 4,500ft; passenger capacity, 44; typical performance, 264 m.p.h. for 750 miles at 15,000ft with 11,200 lb payload.

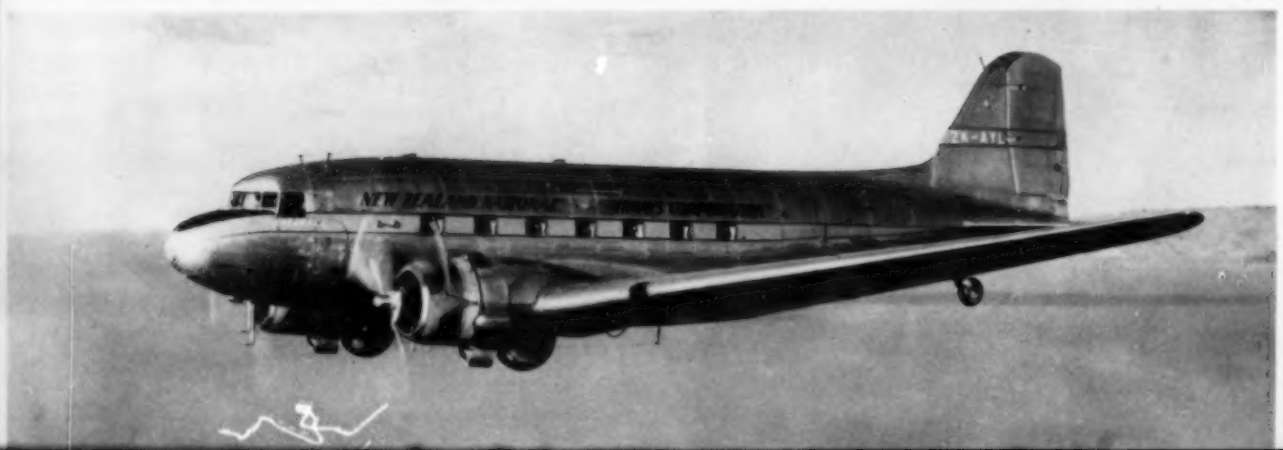
Curtiss Commando (Air Djibouti).

CURTISS COMMANDO • Designed to be competitive with the Boeing Stratoliner and Douglas DC-4, the Curtiss Wright C.W.20 went into production for the U.S.A.A.F. (as the C-46 Commando) shortly after America entered World War II. Altogether 3,141 were built, of which a small percentage remain in service, the majority in North and South America. The largest operators are the two big American all-freight operators, Slick and Flying Tiger, with respective fleets of 19 and 26. Several companies have adopted Turboméca auxiliary jet units as a means of bringing the Commando's take-off performance in line with modern requirements.

Commando (two R-2800, total 4,400 h.p.).—Span, 105ft 8in; length, 76ft 4in; take-off weight 45,000 lb; wing loading, 35.3 lb/sq ft; take-off distance, 4,955ft; passenger capacity, 44; typical performance, 200 m.p.h. for 1,000 miles at 8,000ft with 10,000 lb payload.

De Havilland Heron (Japan Air Lines).

Douglas DC-3 (New Zealand National Airways).



Transport Aircraft • 1954...

12,500—70,000 lb

DE HAVILLAND HERON • The rôle which the Heron was produced to fill is defined by its manufacturers as follows: "Short- or medium-stage domestic service in areas where other forms of travel are a great inconvenience to the public, and where properly developed aerodromes are a rarity . . . the type of operation which calls for frequency and regularity of service, long up-country or inter-island routes, where the traffic density does not justify economically the employment of too large a vehicle and where the public use aircraft as they do buses." The success with which the Heron performs such duties is reflected by the fact that nearly 70 have been sold, and by the results achieved in service with operators in Norway, Australia, Salvador, French Colonies, New Zealand, Jersey, Uruguay, Indonesia and Japan.

The Heron's combination of lively performance, comfort and four-engine security has ensured its rapid acceptance by the travelling public as well as its operators. Simple construction guarantees low maintenance costs and quick turn-rounds of the order expected for "out-back" operation, and daily utilizations of up to nine hours have been recorded. The Heron is in a category of its own and seems likely to remain in demand for several years.

Apart from its airline ability, the Heron is a natural choice for executive or V.I.P. transport; recent orders include one for H.R.H. Prince Talal Al Saud, one for Vickers-Armstrongs and two for firms in South Africa and Canada. Two versions are offered —the Series 1 (fixed undercarriage, as illustrated on the previous page) and Series 2. The latter has retractable wheels, which result in 10 per cent reduction of stage time for journeys of 500 miles.

Heron 2 (four Gipsy Queen 30 Mk 2, total 1,000 h.p.).—Span, 71ft 6in; length, 48ft 6in; take-off weight, 13,000 lb; wing loading, 26 lb/sq in; take-off distance, 2,250ft; passenger capacity, 14-17; typical performance, 183 m.p.h. for 700 miles at 8,000ft with 2,900 lb payload.

DOUGLAS DC-3 • Introduced by American Airlines in 1936 as the D.S.T. (Douglas Sleeper Transport) the DC-3 quickly became the most widely used transport aircraft in the world—a distinction which it retains today. More than 400 were in airline service by 1940 and more than 10,000 military versions (C-47s) were built during the war. It is estimated that some 1,500 genuine DC-3s and converted C-47s are still being used by scheduled and "non-sked" civil operators. No reliable estimate is to be had as to the date of this famous transport's eventual retirement; it seems likely, however, that the majority of DC-3 scheduled services will be taken over by newer aircraft by 1956-57.

Douglas DC-4 (Air France).

So far the DC-3 has defied all efforts to produce a replacement. Even its manufacturers have failed: in 1948 Douglas offered a $300,000 conversion to Super DC-3 standards, increasing speed from 165 to 225 m.p.h. and seating capacity from an average of 25 to 31. Only three Super DC-3s were sold commercially. The U.S. Navy already has well over 100 military versions, styled R4D-8.

DC-3 (two Twin Wasp R-1830 SIC3G; total 2,400 h.p.).—Span, 95ft; length, 64ft 6in; take-off weight, 28,000 lb; wing loading, 28.3 lb/sq ft; take-off distance, 2,680ft; passenger capacity, 28; typical performance, 170 m.p.h. for 1,500 miles at 8,000ft with 6,500 lb payload.

DOUGLAS DC-4 • Production of the DC-4 for American, United and Eastern airlines was under way late in 1941, when America entered the war. Subsequently the type was produced as the C-54 Skymaster, of which a total of 1,163 had been delivered by the end of 1945. The DC-4 emerged from the war with an increase of nearly 50 per cent over its original design gross weight of 50,000 lb. Nearly 600 DC-4s are in civil use, of which some 70 are from the initial post-war production line, the remainder being sold or leased to operators by the United States Government. With the advent of tourist services, many DC-4s have been modified to carry 60 or more passengers, compared with the intended complement of 40. A striking tribute to the usefulness of the DC-4 is the fact that its post-war purchase price of about £150,000 still holds good today after nearly ten years' work.

DC-4 (four Twin Wasp R-2000 2SD13G; total 5,800 h.p.).—Span, 117ft 6in; length, 93ft 11in; take-off weight, 73,000 lb; wing loading, 49.9 lb/sq ft; take-off distance, 5,050ft; passenger capacity, 55; typical performance, 200 m.p.h. for 2,100 miles at 8,000ft with 17,000 lb payload.

FAIREY ROTODYNE • Progress of the Rotodyne is being watched with unusual interest by airline operators, for several reasons. In the first place, the use of a single four-blade rotor with tip-jet propulsion units, together with small conventional airscrews for forward flight, promise to give the Rotodyne an outstandingly flexible performance. For vertical take-off and landing the Napier Eland turbines supply compressed air through a simple valve system to the tip jets. In forward flight most of the power is absorbed by the wing-mounted airscrews, giving an economical cruising speed of "not less than 150 m.p.h." Passenger comfort should benefit from the low vibration characteris-

Fairey Rotodyne.

Fokker F.27 Friendship.

Handley Page Marathon 1.

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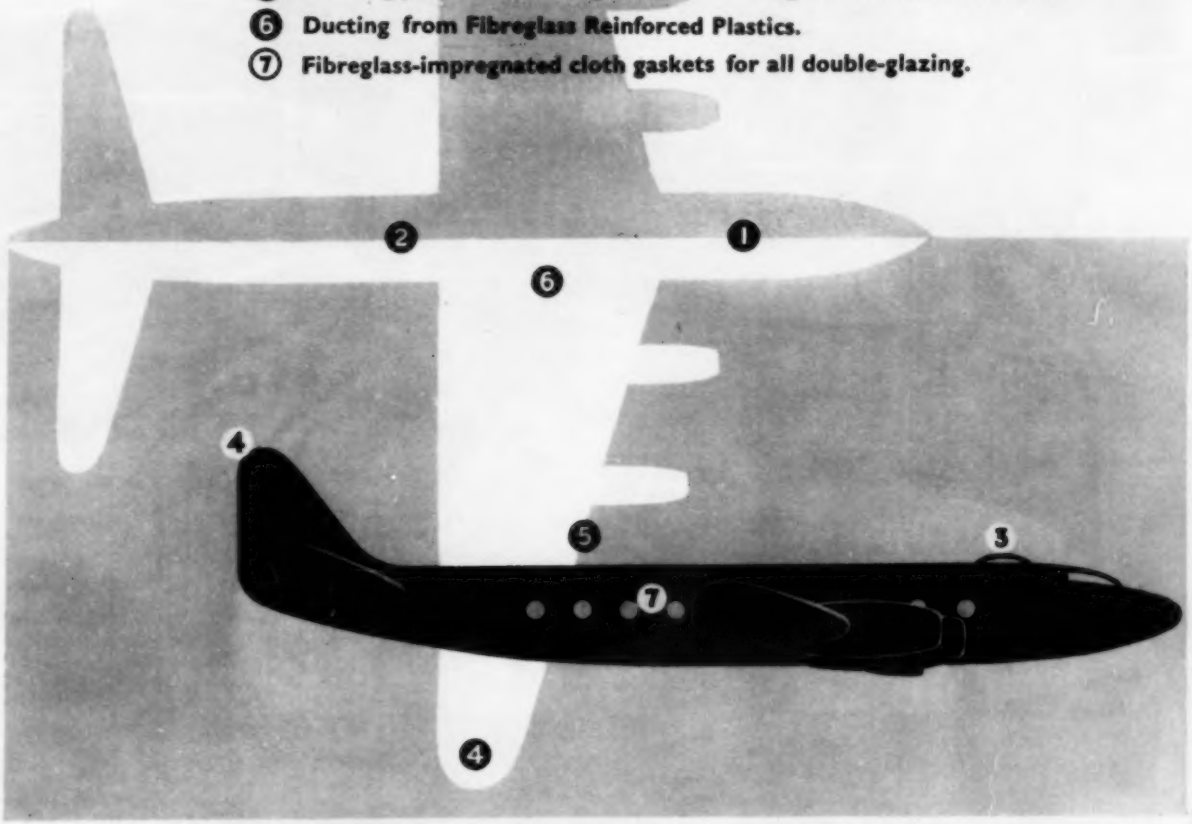

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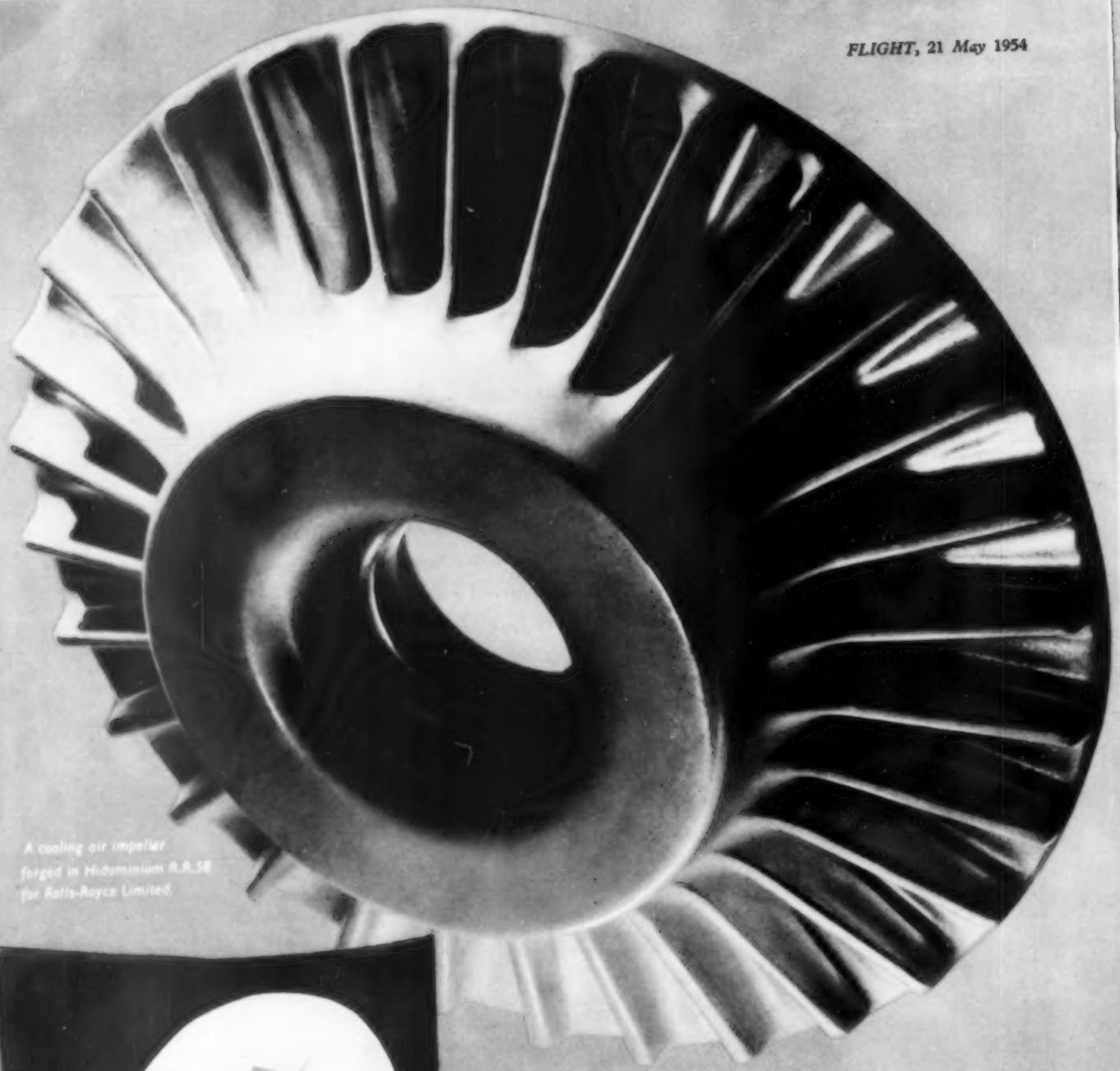

A cooling air impeller forged in Hiduminium R.R.58 for Rolls-Royce Limited.

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Transport Aircraft • 1954...

12,500—70,000 lb

tics obtainable in the absence of the engines, drives and couplings as usually mounted in the fuselages of large helicopters.

Capable of carrying upwards of 40 passengers with full baggage allowance, the Rotodyne will be of the size and power called for by B.E.A.'s specification for a large inter-city helicopter. The end-loaded, unrestricted fuselage will also accommodate cars or freight. Official belief in the potentialities of the Rotodyne was expressed by the placing, last July, of a Ministry of Supply order for construction of a prototype.

Rotodyne (two Elands; total 6,300 h.p.).—Rotor dia. 90ft; wing span 47ft; take-off weight, 31,000lb; disc loading, 4.2 lb/sq ft; passenger capacity, 40; typical performance, 200 m.p.h. for 290 miles with 13,000 lb payload.

FOKKER F.27 FRIENDSHIP • Designed primarily to replace the DC-3, the Friendship was the first twin-turboprop airliner to reach the construction stage. With Government support, two prototypes are being built in the Fokker factory at Amsterdam. From the viewpoint of flight safety special advantages are claimed for the Friendship: auxiliary pneumatic power system has been chosen, all fuel is contained in the outer wings and the standard cabin arrangement (24-36 seats) features rearward-facing seats. The fuselage is pressurized to give a cabin pressure of 8,000ft at a cruising height of 20,000ft, although it is doubtful if this height will be attained over the normal stage-distance of 300 miles.

Friendship (two Dart RDa6; total 3,380 e.h.p.).—Span, 95ft; length, 73ft; take-off weight, 32,630 lb; wing loading, 43.3 lb/sq ft; take-off distance, 3,800ft; passenger capacity, 24-36; typical performance, 260 m.p.h. for 300 miles with 9,535 lb payload.

HANDLEY PAGE (READING) MARATHON • Union of Burma Airways are at present the only operators of this 18-22-seat feederliner. Until recently, six were in service with West African Airways Corporation, but these have now been placed on the market, with low total hours.

Marathon (four Gipsy Queen 70-30; total 1,360 h.p.).—Span, 65ft; length, 52ft 1in; take-off weight, 18,250 lb; wing loading, 36.7 lb/sq ft; take-off distance, 3,000ft; passenger capacity, 20; typical performance, 167 m.p.h. for 810 miles at 8,000ft with 4,260 lb payload.

HUREL-DUBOIS H.D. 32 • In at least one respect the H.D. 32 has a clear lead over other transports aimed at the DC-3 replacement market—the ability to lift larger payloads than the DC-3 from smaller fields. Air France have placed a firm order (for 24) and other operators are likely to follow suit. Unusual features of the H.D. 32 are, of course, the unusually high aspect-ratio of its externally braced wing and the sturdy fixed undercarriage designed for use from grass strips. It employs well-proven Twin Wasp engines, as fitted to the DC-3. One prototype H.D. 32 has flown; the basically similar H.D. 31 (illustrated) has 800 h.p. Wrights.

HD32 (two Twin Wasp R1830-92; total 2,400 h.p.).—Span, 148ft 7in; length, 76ft 4in; take-off weight, 39,672 lb; wing loading, 36.8 lb/sq ft; take-off distance, 2,380ft; passenger capacity, 42; typical performance, 168 m.p.h. for 1,240 miles at 10,000ft with 8,820 lb payload.

ILYUSHIN IL-12 • Standard equipment of the Russian, Polish and Czech airways. Aeroflot, the Soviet national airline, use the type almost exclusively over all stage-lengths up to at least 1,000 miles; this must require at least 100 aircraft, forming the largest fleet in the world of one type. Although of post-war

Hurel-Dubois H.D.31 prototype.

Ilyushin Il-12 (Aeroflot).

design, as indicated by the nosewheel undercarriage, the Il-12 has an unpressurized fuselage.

Il-12 (two Ash-82 FNV; total 3,550 h.p.).—Span, 104ft; length, 69ft 11in; take-off weight, 38,000 lb; take-off distance, 2,700ft; passenger capacity, 30; typical performance, 210 m.p.h. for 1,240 miles at 2,000ft with 8,000 lb payload.

MARTIN 2-O-2 and 4-O-4 • Comparatively little known outside the United States, the 2-O-2 and 4-O-4 are nevertheless among the most numerous of post-war transports. The 2-O-2, an unpressurized 40-seater, was in fact the first post-war American airliner to be certificated, but the type suffered a number of set-backs early in its airline career and most of the market—particularly overseas—was won by its competitor, the Convair 240. About 25 2-O-2s are employed on American domestic routes. The considerably improved Model 4-O-4 has a pressurized cabin and better payload capacity. Eastern Air Lines have a fleet of 60, and 40 more are used on T.W.A.'s domestic services.

Martin 4-O-4 (two Double Wasp R-2800 CB16, total 4,800 h.p.).—Span, 93ft 3in; length, 74ft 7in; take-off weight, 44,900 lb; wing loading, 52 lb/sq ft; take-off distance, 4,360ft; passenger capacity, 44; typical performance, 255 m.p.h. for 900 miles at 15,000ft with 9,000 lb.

Martin 4-O-4 (Trans-World Airlines).

Piasecki YH-16 Transporter (U.S.A.F.).

SAAB Scandia (Scandinavian Airlines System).

Transport Aircraft • 1954 . . .

12,500—70,000 lb

PIASECKI PV-15 TRANSPORTER • It is no secret that, although initial production will be for the U.S. Services, there is a large potential civil market for the PV-15. It is the world's largest helicopter and in civil form will be capable of accommodating 48-72 passengers. An important feature of the Transporter is its wide c.g. range, said to be larger than that of any other aircraft, enabling the load to be placed anywhere in the cabin.

No details of performance have yet been released, but it is thought that the cruising speed, with turbine power, might be at least 150 m.p.h. The 78ft fuselage has a door at the forward end of the cabin and a vehicle- or freight-loading ramp at the rear. Two Pratt and Whitney R-2180 engines deliver a total of 3,300 h.p. to the tandem rotors; projects exist for more powerful variants with gas-turbine power.

Piasecki PV-15 (two R-2180, total 3,300 h.p.).—Rotor dia., 82ft; fuselage length, 77ft; take-off weight, over 30,000 lb.

SAAB 90 SCANDIA • Although the type is not operated on a large scale, the total hours flown by Scandias approaches 50,000 and this 24-36-seat Swedish airliner has built up an excellent reputation for reliability. Six are used on the domestic and European routes of Scandinavian Airlines System, and ten are flying in South America with the Brazilian airline V.A.S.P. Following a repeat order from this operator Saab made an agreement with the Dutch Fokker concern for Scandia production in Holland. There is still a possibility of further orders.

Scandia (two R-2180, total 3,600 h.p.).—Span, 91ft 10in; length, 69ft 11in; take-off weight, 35,280 lb; wing loading, 38.2 lb/sq ft; take-off distance, 3,960ft; passenger capacity, 24-36; typical performance, 236 m.p.h. for 300 miles at 8,000ft with 8,240 lb payload.

SCOTTISH AVIATION PRESTWICK TWIN PIONEER Intimate knowledge of the problems of operating low-cost air services in regions where the construction of conventional airfields is not possible resulted in Scottish Aviation's design for a simple twin-engined airliner with a minimum ground run of 300ft. The Government has guaranteed a measure of support for this promising conception, and a prototype is now progressing at Prestwick Airport. It is hoped that September's S.B.A.C. Show will see the début of the first Twin Pioneer.

Apart from its unique low speed characteristics (engine-off touch-down speed will be 47.5 m.p.h.) the Twin Pioneer's equipped cost of £35,000 will make it an especially interesting proposition to many small operating companies. A three-abreast seating layout is used for the main cabin, which will accommodate 16 passengers with baggage or 14 when a toilet compartment is included. Seat attachments will make provision for either rearward- or forward-facing seats according to the operator's choice.

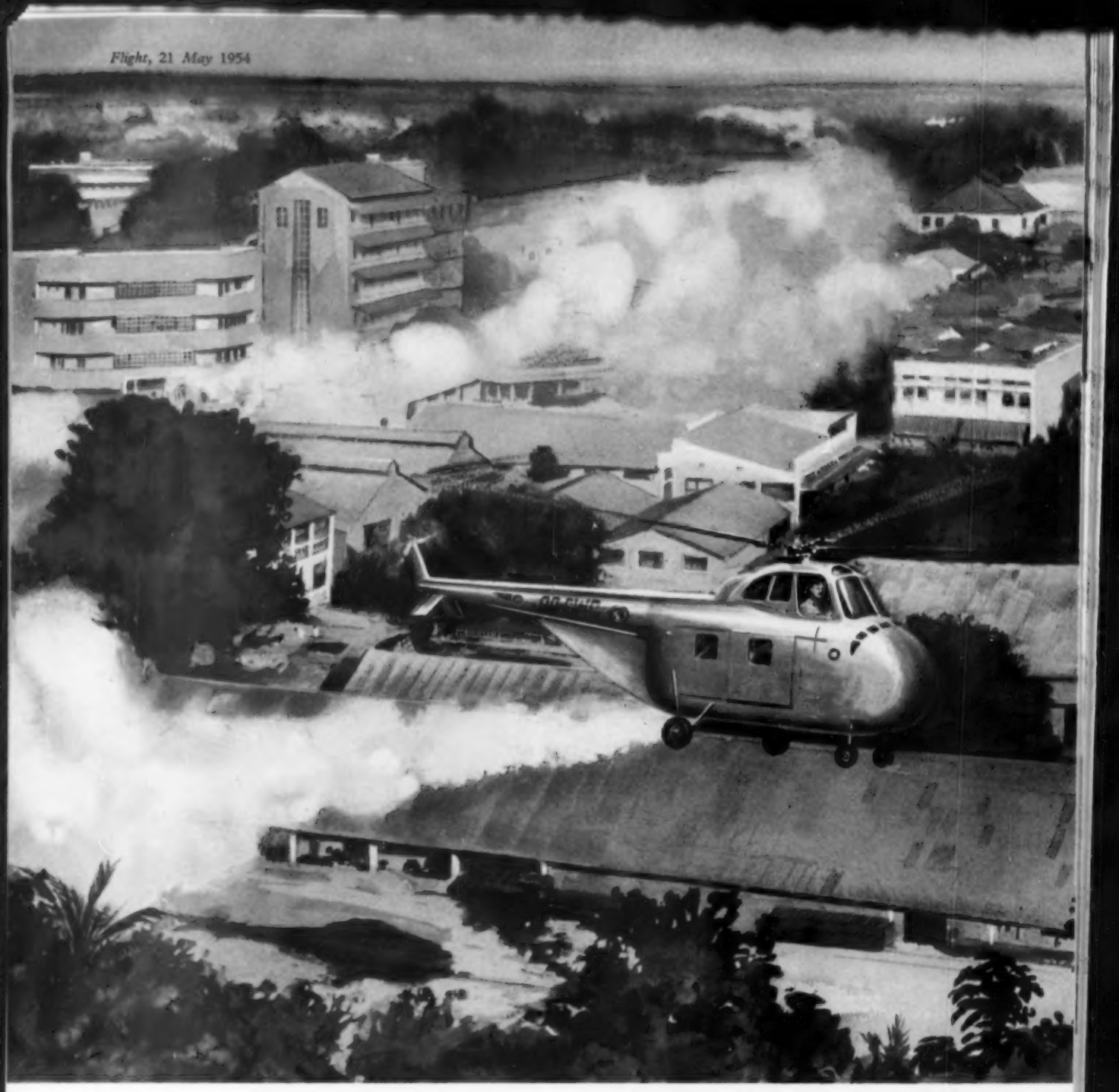
Using the standard civil operating technique with allowances for engine-cut at critical point, the take-off distance to 50ft from a concrete runway at full load will be about 1,000ft. However, it has been suggested that, in view of its extremely low stalling speed, the Twin Pioneer may be permitted to operate at full weight from much shorter fields.

Twin Pioneer (two Leonides 501/2, total 1,100 h.p.).—Span, 76ft 6in; length, 45ft 1in; take-off weight, 13,500 lb; wing loading, 20.5 lb/sq ft; take-off distance, 1,026ft; passenger capacity, 16; typical performance, 140 m.p.h. for 200 miles at 5,000ft with 3,600 lb payload.

Scottish Aviation Twin Pioneer.

Sikorsky S-56.

AER LINGUS
VICKERS VISCOUNT



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Heron Series 1 (fixed undercarriage). The journey from London to Zürich, 490 miles, takes less than 3¾ hours by Heron, with thirteen passengers and their baggage and 165 lb. of freight aboard.

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Heron Series 1 (fixed undercarriage). Fourteen passengers and their baggage can be carried in the Heron on the journey of 315 miles from Nairobi to Entebbe in 2¼ hrs.

A long haul up the Amazon—

Heron Series 2 (retractable undercarriage). The distance from Belem to Manaos is 805 miles and the Heron makes this journey in 4½ hours, carrying ten passengers and their baggage and 80 lb. of mail or freight.

Industrial Executive Duty in U.S.A.—

Heron Series 2 (retractable undercarriage). Carrying eight passengers in luxury, and their baggage and 660 lb. of freight, the Heron makes the journey of 570 miles from St. Louis to Baton Rouge in 3¼ hours.

DE HAVILLAND HERON

(Four de Havilland Gipsy Queen 30 Mark 2 engines driving de Havilland 1000-size two-blade, variable-pitch, non-feathering propellers.)

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SIKORSKY S-56 • According to its designer, Mr. Igor Sikorsky, his new S-56 twin-engined helicopter will be available to commercial operators within two or three years. Already two operators—National Airlines and Mohawk Airlines, both of whom have S-55s—are reported to be negotiating for the 35-seat passenger version. The military prototype, designated XHR2S and prepared to the U.S. Marine Corps specification for an assault transport, was recently inspected by the Editor of *Flight* at Bridgeport, Connecticut. He describes it "as a magnificent machine."

Unusual features of the S-56 are the pods, mounted on stub wings, which house both the engines (1,900 h.p. R-2800) and the main wheels of the retractable tail-wheel undercarriage. The five-bladed rotor is driven by a centrally mounted gearbox. Cruising speed is expected to be in the region of 150 m.p.h.

It is reported that a more advanced version will use Allison T56 turboprops.

S-56 (two R-2800, total 3,800 h.p.).—Rotor dia., 90ft; fuselage length, 60ft; take-off weight, 28,500 lb.

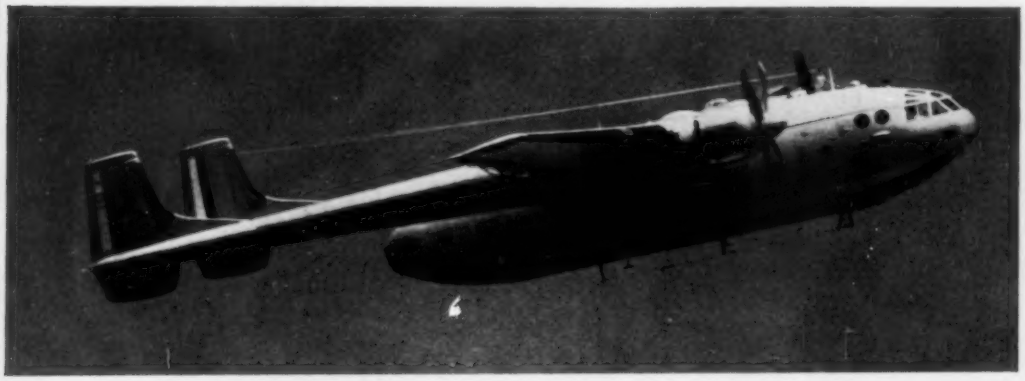
S.N.C.A.N. 2501 NORATLAS • The *version civile* of this Packet-like twin-boom transport has been ordered for airline service in South America, following a successful tour of that continent early last year. The large rear-loaded fuselage lends itself particularly to the carriage of mixed payloads—passengers, vehicles and bulky freight. The length of the cabin is 33ft and the other dimensions are 9ft (width) and 8ft (height). Normal passenger capacity is for 40 people in four-abreast seats. British power plants are employed—Bristol Hercules 758s built in France under licence by S.N.E.C.M.A.

Noratlas (two Hercules 738 or 758; total 4,140 h.p.).—Span, 107ft; length, 72ft; take-off weight, 43,210 lb; wing loading, 43.2 lb/sq ft; take-off distance, 2,690ft; passenger capacity, 40; typical performance, 190 m.p.h. for 750 miles at 6,000ft.

S.N.C.A.S.O. 30P BRETAGNE • A 40-seater of conventional design, the S.O. 30P Bretagne is serving on French colonial routes and in Indo-China, over stage-lengths of up to 1,000 miles. Two versions have been produced, one with 2,000 h.p. R-2800 B43s, the other with R-2800 CA18s, each producing 400 extra h.p. at take-off. As a means of improving the performance of the early version without spending hard currency on the more powerful B43 engines, some operators have fitted their Bretagnes with Turboméca Palas auxiliary jets, thereby increasing payload by some 2,200 lb.

Bretagne (two R-2800; total 4,000 h.p.).—Span, 96ft 5in; length, 62ft 2in; take-off weight, 43,000 lb; wing loading, 45 lb/sq ft; take-off distance, 5,725ft; passenger capacity, 40; typical performance, 258 m.p.h. for 620 miles at 6,000ft with 7,000 lb payload.

VICKERS - ARMSTRONGS VISCOUNT • Successful introduction of Viscount services by three airlines—B.E.A., Air France and Aer Lingus—must be classed as the outstanding air-transport event of the past twelve months. Since the maiden flight of the prototype model 630, the world's first turboprop airliner, on July 16th, 1948, the Viscount story has been one of uninterrupted progress. The original aircraft, weighing 38,650 lb was designed to carry a maximum of 36 passengers; today's Viscounts are delivered with a permitted a.u.w. of 58,500 lb (and are stressed for 60,000 lb to allow for future power-increase) and will carry up to 59; and the "stretched" Viscount 800, ordered for B.E.A. service next year, will lift as many as



S.N.C.A.N. Noratlas.

S.O. Bretagne.

Vickers-Armstrongs Viscount 701 (B.E.A.).

Transport Aircraft · 1954...

12,500—70,000 lb

83. The take-off weight of this short-stage, high-density version will be 65,000 lb. These developments, as Vickers-Armstrongs justifiably point out, by no means cover all future improvements to the Viscount—which, for a modern airliner, is still at an early stage in its working life.

The genuinely outstanding features of the Viscount may briefly be summarized as follows: cruising speed (310-320 m.p.h.) greater than for any other medium-stage airliner and all but the newest of long-haul transports; extreme passenger-appeal, conferred largely by low degree of vibration, steadiness in flight and large windows; good safety characteristics, resulting from bag-type tanks, kerosine fuel and unexcelled ratio of exit-hatches per passenger; operating economy over 300/1,200-mile band of stage-lengths (B.E.A. reported a direct-cost break-even load factor of 28 per cent after the first six months of scheduled service).

Orders for Viscounts now total 93, and total potential sales are variously estimated as 200-400. Customers include B.E.A. (26 Series 701s, of which 20 are in service, as well as 12 Series 800s), Trans-Canada Air Lines (15) and Air France (12). The T.C.A. deal, achieved in the face of strong competition, is particularly significant, since it should quicken the prospects of further North American sales. Capital Airlines—America's fifth largest carrier in terms of total passengers (2¼m last year)—were showing particularly keen interest in the Viscount at the time of writing. For dense routes, the Viscount is the foremost potential replacement for the DC-3 and DC-4—and Capital alone have 25 of each.

Viscount (four Dart RDa.6; total 6,200 s.h.p.).—Span, 93ft 8in; length, 81ft 2in; take-off weight, 60,000 lb; wing loading, 59.1 lb/sq ft; take-off distance, 4,900ft; passenger capacity, 47; typical performance, 323 m.p.h. for 900 miles at 20,000ft with 13,320 lb payload.

Vickers Viking (Hunting-Clan Air Transport).

VICKERS - ARMSTRONGS VIKING • This useful medium-range 36-seater is reaching the twilight of its seven-year period of service with B.E.A. By this we do not imply that the Viking's days as an international airliner are over, although the Viscounts and Elizabethans, there remain in service a large proportion of the 150 civil Vikings produced. Present operators are to be found in Britain, Egypt, Iraq, South America, Southern Rhodesia and the West Indies. In addition to their own fleet of seven, Eagle Aviation have an option on all ex-B.E.A. Vikings.

Viking 1B (two Hercules 634, total 3,380 h.p.).—Span, 89ft 5in; length, 65ft 4in; take-off weight, 34,000 lb; wing loading, 38.5 lb/sq ft; take-off distance, 4,800ft; passenger capacity, 27-36; typical performance, 200 m.p.h. for 700 miles at 8,000ft with 8,000 lb payload.

UNDER 12,500 lb

BRISTOL 171 • The Type 171 Sycamore was Britain's first production helicopter. Although it was the product of an embryo design-team with virtually no helicopter experience, the soundness of the concept can be judged by the fact that the type is in full production, with some dozens already in service. Most Sycamores are military aircraft, but B.E.A. have two special Mk 3As which are five-seat transports with large rear baggage holds, and equipped with a variety of airline radio equipment. Although not used on scheduled services, these Sycamores are assisting the Corporation in their search for optimum techniques and useful experience, which will be of inestimable value when bigger helicopters become available.

Sycamore (one Leonides 73, total 560 h.p.).—Rotor diameter, 48ft 7in; length, 46ft 2in (folded); take-off weight, 5,400 lb; disc loading, 2.86 lb/sq ft; take-off distance, nil; passenger capacity, 4; typical performance, 90 m.p.h. for 270 miles at sea level.

Bristol 171 (B.E.A.).

De Havilland Beaver.

DE HAVILLAND BEAVER • The Beaver was the second design by M. Jakimiuk to go into production at D.H. Canada's Toronto factory. Since 1951 production has been continuing steadily at a mean rate of about one aircraft per day, and the 500th was delivered last winter to the Government of the Falkland Islands. Although most Beavers are used by the U.S. Army, a fair number are on civil registers. Perhaps surprisingly, two major airlines, Central African Airways and Malayan Airways, employ Beavers on scheduled services over inhospitable jungle.

Beaver 2 (one Leonides 502/4; total 550 h.p.).—Span 49ft; length, 31ft 9in; take-off weight, 5,100 lb; wing loading, 20.4 lb/sq ft; take-off distance, 750ft to 50ft; passenger capacity, 7; typical performance, 138 m.p.h. for 600 miles with 1,000 lb payload.

DE HAVILLAND DOVE • No other British aircraft is in such world-wide service as is this neat light twin-engined transport, which was clearly ahead of its time when it appeared in 1945. Fully succeeding in its aim at providing every "mainliner" feature in a small aircraft, the Dove is all-metal and has the most powerful of all Gipsy Queens for power: Series 70/4 of 345 h.p. in earlier Doves and 380 h.p. 70 Mk 2s in present machines.

The production line at Chester is now smaller than the adjacent line of Herons, but production is continuing, with a total of nearly 500 sold. Of this impressive number, over 60 are in use in the U.S.A., for which market a special executive version has been developed. Other Doves are special "universal" models, capable of speedy conversion for use as 11-passenger transports, five-seat executive machines, ambulances, or any other required

De Havilland Dove.

role. Many airlines continue to use Doves on scheduled services.

Dove (two Gipsy Queen 70; total 680 h.p.).—Span, 57ft; length, 39ft 6in; take-off weight, 8,500 lb; wing loading, 25.3 lb/sq ft; take-off distance, 2,400ft to 50ft; passenger capacity, 8; typical performance, 180 m.p.h. for 500 miles with 1,500 lb payload.

HUNTING-PERCIVAL PRINCE • Powered by two Alvis Leonides, the Prince is in large-scale production for all kinds of military, industrial and commercial purposes, including crew-training, radar calibration, photo-surveying, all-weather company liaison and normal transport work. The layout provides an exceptionally roomy cabin with a low-level floor, large doors, big windows with perfect vision, and an exceptionally good short-field performance. The Prince is possibly the most adaptable aircraft in its class, and has been widely accepted in many parts of the world.

Present aircraft have a 56ft wing and an all-up weight of 11,000 lb, but later Princes (Series V) will have the characteristics of the R.A.F. Pembroke, with a high-aspect-ratio wing of 64ft span and an all-up weight of 12,500 lb.

Prince (two Leonides 502/4; total 900 h.p.).—Span, 56ft; length, 42ft 10in; take-off weight, 11,000 lb; wing loading, 30.1 lb/sq ft; take-off distance, 2,200ft; passenger capacity, 12; typical performance, 175 m.p.h. for 848 miles at 3,000ft with 1,300 lb payload.

SHORT SEALAND • Since 1951 numerous examples of this neat 5-8 passenger amphibian have gone into service in all parts of the world. Powered by two D.H. Gipsy Queen 70/4 engines driving reverse-pitch airscrews, the Sealand is being used in such work as scheduled service along the Dalmatian coast for Yugoslav Airlines, liaison between tea plantations in Assam, and missionary work in New Guinea.

At present, the Sealand is in a class of its own. The type has amassed considerable flying time under arduous conditions, and the Dove-type power plants are among the most highly developed in the world. The Sealand can be operated—and brought to anchor—with a flight-crew of one. The basic design is also available as a simple flying-boat, with an increase in payload gained by eliminating the land undercarriage.

Sealand (two Gipsy Queen 70; total 680 h.p.).—Span, 61ft 6in; length, 42ft 4in; take-off weight, 9,100 lb; wing loading, 25.4 lb/sq ft; take-off distance, land, 2,500 to 50ft, sea 3,000ft to 50ft; passenger capacity, 8; typical performance, 127 m.p.h. for 522 miles at 5,000ft.

SIKORSKY S-55 • Of the 1,000 helicopters made by Sikorsky at Bridgeport, the majority have been military S-55s; only some 20 have been bought by civil operators. This distressing ratio is largely brought about by the high unit price of such aircraft (at least £50,000), and it must also be admitted that even this, best of all current helicopters, has characteristics which virtually preclude operation at a profit. Four airlines, three American and one Belgian (Sabena) use the S-55 on scheduled passenger services, the latter airline operating a pioneering network of routes connecting Holland, Belgium, Luxembourg, France and Germany.

Also manufactured by Westland Aircraft in England and the S.N.C.A.S.E. group in France, the S-55 appears to be a useful type upon which airlines can collect experience, pending the availability of more competitive equipment. The quoted payload and seat capacity can be as much as one ton or ten passengers, but only about half as much is normally carried in practice.

S-55 (one Wasp R-1340; total 600).—Rotor dia. 53ft; take-off weight, 6,800 lb; disc loading, 3.08 lb sq/ft; passenger capacity, 7; typical performance, 86 m.p.h. for 250 miles with 1,000 lb payload.

Hunting-Percival Prince IIIB (M.T.C.A.).

Short Sealand.

Sikorsky S-55 (Sabena).

Departure of the B.O.A.C. Stratocruiser which carried H.M. the Queen and H.R.H. the Duke of Edinburgh on the first stage of their Commonwealth tour.

AIR COMMERCE • Aims,

ONE of the tasks of the International Civil Aviation Organization is the collection of statistics measuring the progress of air transport. With the aid of reporting forms filed by all the scheduled airlines, the I.C.A.O. statistics branch succeeds in discovering such items as the amount of excess baggage carried by Ethiopia's airline in 1951; the load factor for Thailand last August; or the cost in 1952 of airline publicity in the Lebanon.

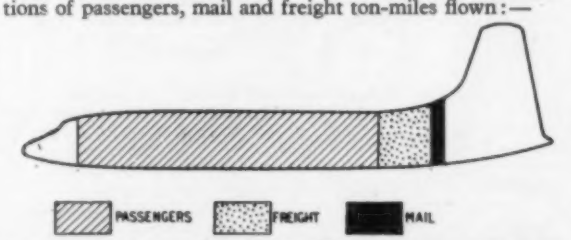
While these figures might justly be regarded as being of only specialized interest, the I.C.A.O. calculating machines produce quite spectacular results at the end of each year, when all airlines' traffic results are added into one huge sum.

The latest example, issued on December 29th last, is given at the foot of this column. Traffic for several successive years is shown. A remarkable rate of growth is immediately apparent, although most of the totals are too vast to be appreciated out of context. Even the statistical experts must find it difficult to form a mental picture of 28,580,000,000 passenger-miles. Probably the most easily digested total is the number of passengers carried by scheduled airlines last year—52 million. One million per week! Truly an impressive number for a mode of transport which was in its infancy 30 years ago.

Despite the tendency of airlines to employ obscure units of measurement (e.g., gold francs per tonne-kilometre), it is our belief that air-transport statistics, taken in moderation, can tell an interesting and informative story. We hope that the following survey, prepared largely for non-specialists, will bear us out.

We begin with the ton-mile,* because it expresses the basic work of the air-transport industry: a load of *x* carried a distance of *y*. Ton-miles "available" express output—the product of weight capacity offered and the total distance flown for a given journey(s); and ton-miles "performed" measure the amount of work actually sold. The available ton-mile is perishable as well as valuable, since it vanishes the moment an aircraft taxies away from the apron with payload capacity remaining unsold. The amount of wastage can be determined from the weight load-factor—the proportion of ton-miles sold to ton-miles available. In 1953, the scheduled airlines succeeded in selling a little under 60 per cent of the ton-miles produced.

Total ton-mile traffic of these airlines last year was nearly 4,000 million. This illustration shows the approximate proportions of passengers, mail and freight ton-miles flown:—



**Short tons (2,000 lb) and statute miles are the standard units.*

Year	Miles flown	Pass. carr.	Pass. miles	Cargo ton-miles	Mail ton-miles	Av. no. pass. per a/c.	Av. dist. flown per pass.
	millions					(no.)	(miles)
1953	1,170	52.0	28,580	700	185	24.5	550
1952	1,059	45.0	24,540	651	175	23.2	547
1951	976	39.9	21,380	612	160	21.9	536
1950	890	31.2	16,960	518	143	19.1	544
1949	836	26.5	14,480	390	128	17.3	546
1948	789	23.5	12,990	286	114	16.5	552
1947	708	21.0	11,740	187	88	16.6	559
1937	165	2.5	880	n.a.	n.a.	5.3	350
	Percentage increase or decrease between years						
1952-53	+10	+16	+16	+7	+5	+6	+1
1951-52	+9	+13	+15	+6	+9	+6	+2
1950-51	+10	+28	+26	+18	+12	+15	−1
1949-50	+6	+18	+17	+33	+12	+10	−1
1948-49	+6	+13	+11	+36	+13	+5	−1
1947-48	+11	+12	+11	+53	+30	−1	−1
1947-53	+65	+148	+143	+274	+111	+48	−2
1937-53	+607	+1,980	+3,162	n.a.	n.a.	+362	+57

Exclusions: China and U.S.S.R. n.a.—not available.

A large part of the total airline traffic is performed by a comparatively small number of major airlines. This can be illustrated by quoting a few figures published by well-known companies:—

Operators	Ton-miles performed (1953)
American Airlines	403 million
Trans-World Airlines	335 ,,
British Overseas Airways Corporation	137 ,,
Trans-Canada Air Lines	89 ,,
British European Airways	51 ,,

The value of the ton-mile performed varies enormously in relation to (a) the class of payload concerned and (b) the efficiency of the operator. Broadly speaking, freight brings the lowest return, passengers pay about twice as much per ton-mile, and mail revenues are nearly always relatively high. Here are some recent examples of actual payments made, as shown in the published annual reports of the airlines concerned (the figures are approximate):—

Operators	Revenue per ton-mile performed		
	Passengers	Mail	Freight
American Airlines	4s 0d	3s 2d	1s 8d
British European Airways	6s 4d	9s 3d	3s 8d
British Overseas Airways Corporation	4s 11d	10s 3d	2s 7d
Trans-Australian Airlines	3s 9d	11s 8d	2s 1d
Trans-Canada Air Lines	4s 7d	9s 3d*	3s 4d

*Domestic services only: T.C.A.'s North Atlantic mail pay in 1952 was 18s 4d per ton-mile.

The reasons for these wide variations in the price of an essentially similar product will emerge more fully in pages to follow. Meanwhile, it will be seen immediately that the Australian, American or Canadian can fly farther or more often for a given expenditure than the British passenger. So far as domestic travel is concerned, this is largely explained by the fact that Australian and American operating conditions favour the mass production of air transport, with the ensuing reduction in cost to the user.

With the birth of an era of mass air travel, flying is not always the glamorous business suggested by the photograph at the foot of this page. The point is brought home vividly by this Burmese DC-3 interior, with its mixed payload of passengers and freight.

Problems, Achievements

ROBERT J. BLACKBURN

Passengers require more expensive handling than freight, which can consequently be carried at lower rates. Both passenger and cargo revenues bear a reasonable relationship to the cost of production, but this is clearly not true of mail pay—except in the case of the large American domestic airlines. There is an element of subsidy in the mail rates paid to the vast majority of operators, including the U.S. international lines.

Variations in revenue rates can more conveniently be studied under the three main classes of payload—passengers, mail and freight.

Passengers. The per-mile cost of passenger air travel might be regarded as an expanding gateway with the airlines on one side and the public on the other. The lower the cost, the wider the gateway becomes; and as more people pour through, so does the gateway widen further. A rule-of-thumb estimate is that a 10 per cent fare-reduction brings a 20 per cent increase in traffic.

Post-war civil aviation received its initial impetus from

Luxurious long-range travel is typified by the first-class lounge of this K.L.M. Super Constellation, complete with "fine-arts mural."

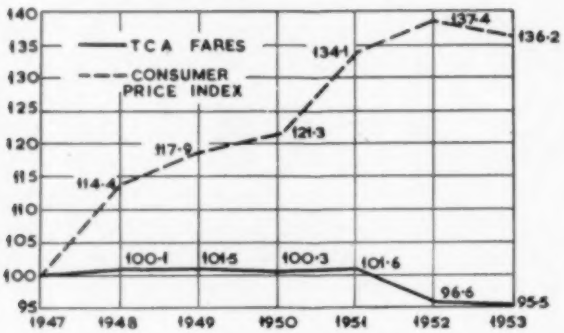
Many long-haul aircraft now feature "mixed-bag" interiors, illustrated here by a T.C.A. Super Constellation with accommodation for both first-class (below) and tourist passengers (above).

The contrast between first-class and tourist cabin accommodation is brought out by these interiors: (above) the aft cabin of a T.A.I. DC-6B and (below) a high-density Constellation.

Air Commerce . . .

the disposal at give-away prices of ex-military transport aircraft. Replacement, with new airliners costing up to £1 million each, means that every ticket sold must cover a fraction of depreciation (as much as £500 per day for a four-engined transport). However, since the new aircraft are specifically designed to operators' requirements, they are more efficient, and it has been possible for airlines to absorb replacement costs while consistently reducing fares in order to attract the mass market. Occasionally one hears the complaint that the cost of air travel has gone up over the past few years, but in fact a person who pays 10 per cent more to fly from A to B may well be earning 50 per cent more salary. But for the fact that air travel has become a relatively cheaper commodity the airlines would not have experienced a 100 per cent increase in passenger traffic over the past five years.

Fig. 2, taken from the annual report of Trans-Canada Air Lines, can be regarded as fairly representative:—



It would not be quite fair to assume that improved aircraft efficiency has been wholly responsible for the trend towards lower fares. The other major factor has been the introduction of "tourist" services, by which is normally meant the compression into a passenger cabin of as many people as it will decently hold. A "tourist" layout usually implies a row of five seats abreast where there were previously four, or—where cabin-width is insufficient—a reduction in seat pitch (fore-and-aft spacing). Sometimes both methods are employed, producing a relative degree of discomfort felt most by those fortunates who normally fly "Monarch," "President" or "Golden Parisien."

These words are not written as criticism of the tourist policy, which has brought the era of mass air travel closer to millions of people, and has ensured continuity of expansion in an industry which cannot afford *not* to expand. We hope, however, that the days of comfortable air travel are not fading for ever, and that the operating economics of future transports will not be entirely based on high-density seating arrangements.

Air travel today costs the passenger an average of 5½d per mile, although, according to the region concerned, tickets may work out at half this rate or, at the other end of the scale, three times as expensive. Nevertheless, there are signs that fare-reduction is approaching a lower limit in some regions—notably Australia and North America.

In last year's Commercial Aviation issue of *Flight*, we published a miniature survey of per-mile passenger charges on various routes. Subsequently Aviation Studies, Ltd., published a more detailed examination[2] from which we quote the representative rates (in pence) show in the table at the top of the opposite page.

On international routes the International Air Transport Association determines a standard fare for competing carriers. Since all international airlines receive some form of subsidy, uncontrolled competition would result in a rate war at public expense. This occurred in Europe before 1939, when only two-fifths of the airlines' revenue was produced by traffic[3]: subsidy provided the remainder. Nevertheless, a degree of competition enters into the I.A.T.A. rate-making process, since the fares are determined at traffic conferences between representatives of all the member airlines. Competition

Route	Distance (st. miles)	Fares per mile 1st	2nd	3rd
Regional:—				
Sydney-Melbourne	439	3.6	3.2	—
New Delhi-Calcutta	820	4.1	4.8	—
Auckland-Christchurch	479	4.3	—	—
New York-Chicago	730	5.3	3.8	—
Montreal-Winnipeg	1,248	6.3	5.0	—
Amsterdam-Rome	813	8.1	6.1	—
Trinidad-Barbados	213	10.4	—	—
Intercontinental:—				
Sydney-London	11,625	5.2	4.9	—
Sydney-Johannesburg	8,665	6.0	—	—
Amsterdam-Curacao	6,259	6.7	5.8	—
London-Johannesburg	6,101	6.8	5.5	—
Paris-Saigon	6,831	6.9	5.9	5.5
London-Nairobi	4,832	7.6	5.8	4.5
Brussels-Leopoldville	4,021	8.2	6.6	—
London-New York	3,540	9.5	6.6	—
Paris-Rio de Janeiro	5,729	10.1	—	—

from shipping, rail and coach companies ensures that the I.A.T.A. delegates will agree on the lowest fare compatible with operating costs.

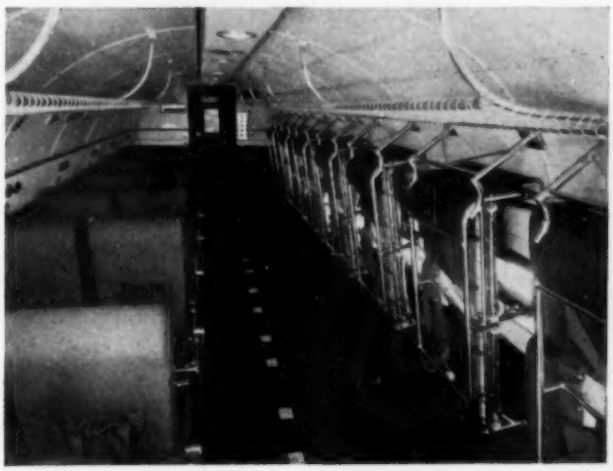
Airlines which operate both domestic and international services are sometimes able to cover short-haul losses by long-haul profits. A high proportion of European regional services are unprofitable, whereas the Atlantic, African and Far Eastern services, relatively speaking, make money. This is illustrated by B.E.A.'s £1m-plus loss compared with B.O.A.C.'s profit. Unless short-haul routes are heavily patronized and run with extreme efficiency a loss is almost inevitable.

Where natural obstacles in the form of mountains or water result in slow surface travel, or where surface transport is under-developed for economic reasons, there can be an excellent demand for an air service even on short routes. The cross-Channel ferry operated by Silver City Airways, which carried 100,000 passengers and 40,000 vehicles last year, is the perfect example. On Europe's busiest inter-city route, that between London and Paris, the per-mile rate (tourist) for a single fare is nearly 8d. Any efficient operator of modern aircraft, given the London-Paris monopoly, could probably halve this figure and still make a profit. If, however, all the profitable European routes were taken away from their present operators losses would soar and governments would have to dig still deeper into national pockets.

B.E.A.'s chief executive has said that all his airline's routes of over 260 miles are profitable,[4] while all shorter routes lose money. It might be argued that in such circumstances there is a strong case for a clear division, at least from the accounting viewpoint, of domestic and international traffic (most of the domestic routes are below 260 miles, whereas the average international stage is over 300). Under the persent system there is a possibility that development of international traffic will be held back (through increasing or pegging of fares) by attempts to show a paper profit. The blunt truth, on the basis of B.E.A.'s results, is that present equipment is incapable of showing any sort of profit on the overall network of British domestic routes, competing as it does with the densest pattern of surface communications—and some of the worst flying weather—in the world.

Development of a large, efficient and reliable helicopter promises to change the picture entirely. Even so, the helicopter's inherently restricted ton-mile output makes it difficult to forecast big reductions in fares. Time-saving will be the main factor influencing the passenger who flies by helicopter in preference to land or sea.

A recent official survey[5] of European air transport, conducted by the Air Research Bureau on behalf of six airlines, found that the introduction of helicopters "should theoretically only influence about seven per cent of the present market." But in America some nine million passengers annually make air journeys on distances of 100-250 miles.[6] This is little more than a tenth of the total traffic within this band of stage-lengths, so there promises to be a big U.S. market for large passenger-carrying helicopters capable of efficient operation. The American industry is already off the mark with military prototypes capable of adaptation for airline service within the next few years.



Two more unusual cabin layouts: an Eagle Aviation Viking (left), with folding Paymaster seats to permit quick conversion of the interior for freighting duties; and the standard layout of B.E.A.'s 47-seat Viscounts, which employ both forward- and rearward-facing seats.

Mail. Although the ton-mileage of mail flown annually by the airlines is only about a quarter of the freight traffic, it produces more revenue. Relatively generous payment for carriage of mail is a traditional method by which governments have encouraged the growth of air traffic. This can be considered as a form of subsidy or—from the operators' viewpoint—as fair payment for valuable service, even though the rates are not normally based on the cost of carriage. The important point about airmail service is that it benefits the public as a whole and not only the person who can afford to fly himself or to consign freight by air. The actual weights involved in mail traffic are relatively small and the charges for transporting mail are widely dispersed over millions of users. For example, the proportion of the public who can afford to travel 3,000 miles at 5s 6d per ton-mile (about 6d per passenger-mile, the cost of a ticket being £75) is extremely limited; by contrast, there is practically no limit to the number who can afford to spend 5½d for sending a one-ounce letter the same distance at the same rate. Taking into account the saving of a week or more in time of dispatch, a higher rate is justified—and in fact is normally paid. Each government, through its postal authority, determines the rate paid for mail carried by its own airlines, usually on a ton-mile or ton-km basis.

Mail originating in one country and carried by the airline of another nation is, however, paid for at a standard rate of four gold francs per tonne-kilometre—about 10s 2d per ton-

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mile. This rate was determined by the Universal Postal Union in 1952. The rate was previously 50 per cent higher, and the U.P.U.'s action in reducing it brought loud but unavailing protests from the airlines. Whether a proportionate decrease in postal charges has been passed on to the public is doubtful. There are unlikely to be large annual increases in first-class mail traffic, since the present total already represents about two-thirds of present traffic. However, attempts will no doubt be made to increase loads of second-class mail and parcel post, and of newspapers (for which U.P.U. rates are 4s 4d and 3s 6d per ton-mile respectively).

Most governments tend to assist their own airlines by restricting the amount of national mail traffic awarded to foreign carriers. This is an understandable policy, but it has the unfortunate overall effect of producing heavy one-way loads and empty mail compartments in the reverse direction.

Freight. Even though freight rates are relatively low the airlines have not yet succeeded in attracting more than a trickle of cargo traffic—by comparison with the flow of passengers. And despite the optimistic predictions of recent years, freight traffic has not expanded in proportion to the overall growth of air transport. Last year passenger-mileage increased by 16 per cent, whereas cargo ton-mileage went up by only 7 per cent; 1952 saw a 15 per cent increase in passenger traffic, but only a 6 per cent gain for freight.

The great majority of air cargo is carried as make-weight in passenger aircraft, and the era of mass air-freighting will dawn only when genuine cargo aircraft become available.

Most DC-3s today carry up to 30 passengers in four-abreast seating, as in this B.K.S. Air Transport version. The East African Airways Dakota (below), modified to carry H.M. the Queen last month, recalls the luxurious form in which the original DC-3 appeared in the 1930s.

The best results have been achieved so far by American all-freight airlines—notably Slick and the Flying Tiger Line—using war-surplus Commandos. Two big scheduled carriers, American Airlines and K.L.M., have achieved excellent results with Douglas DC-6A Liftmasters, adapted from the DC-6 passenger airliner for freight work. Among non-scheduled companies, the outstanding cargo carrier is Seaboard and Western Airlines, who estimate[7] that there is a potential transatlantic market of 8,000 tons annually for the five Super Constellations (cargo version) which they have on order.

Last January it was announced that Seaboard had been recommended for a five-year licence to operate scheduled all-freight services across the North Atlantic. This recommendation awaits the final approval of the C.A.B. and of President Eisenhower. Airwork, Ltd., a well-known British independent company, now holds all the necessary permits for such a service but has not yet begun operations. Meanwhile, the only all-freight flights across the North Atlantic conducted at present are those of K.L.M. and P.A.A., with DC-6As, and T.W.A. (DC-4s).

Total annual air-freight traffic on the North Atlantic route, including loads carried by normal passenger services, is estimated as 10,000 tons. It is further estimated that a new rate structure, based on the ton-mile costs of such aircraft as the DC-6A and Super Constellation freighter, would at once attract an extra 20,000 tons.

On shorter routes, the unique Bristol Freighter has proved the advantages which a specialized cargo aircraft can offer. Had operators assessed the post-war market with greater accuracy it is probable that a better selection of cargo aircraft would be available by now.

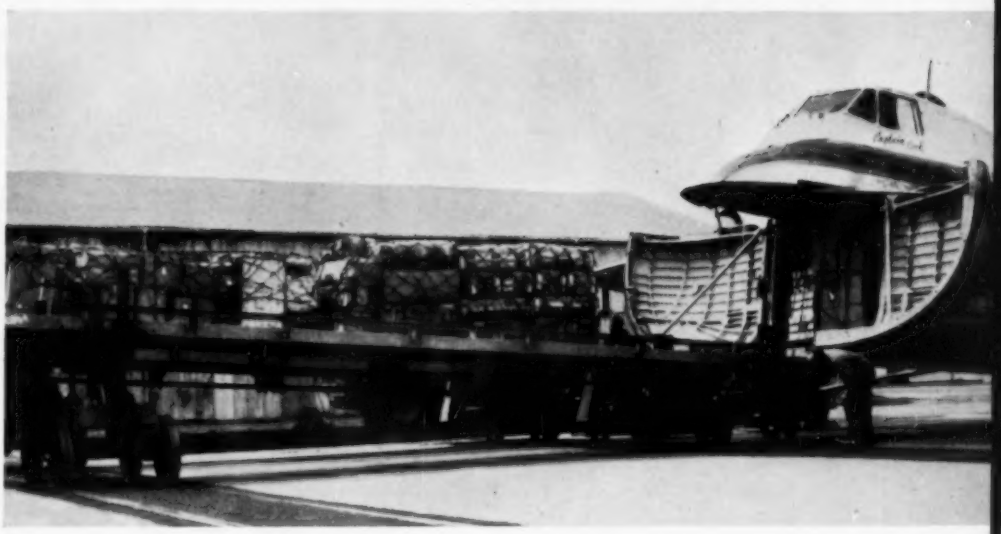
Even in America, the land of mass-produced air transport, only about one ton of freight in 360 moves by air.[8] The largest annual uplift is by American Airlines, who flew 52m cargo ton-miles last year, followed by Slick (46m) and Flying Tiger (38m). These two independent (non-subsidized) carriers, incidentally, are in the process of merging—a union which will result in the largest air-cargo fleet in the world: 43 Commandos, four DC-4s and three DC-6As.

It has been said[9] that the average cost of ocean freight is around £10 per ton, compared with £500-£1,500 per ton for long-distance air freight. However approximate these figures may be, they provide a background against which the real potentialities of air freight may be assessed.

The advantages of the air freighting method are based mainly, but not exclusively, on saving of transit time. They include lighter packing; the almost complete elimination of pilferage risks; lower insurance; reduction of capital tied up in overseas stocks, since deliveries can be made by air within a few days to any part of the world; and the ability, under special circumstances, to move equipment and supplies to isolated areas without building roads or railways.

Small and valuable goods—bullion, drugs and optical equipment are favourite examples—clearly constitute the largest market for air freighting. At the same time, there are isolated examples of large and bulky objects which are moved by air regardless of cost, such as engine parts or propeller shafts for ships—and, of course, spare components for aircraft stranded on a long-haul route.

Outstanding recent developments in the field of air-freighting have been the growth of Silver City Airways' cross-Channel ferry service (left), operated with Bristol 170s, and the introduction of DC-6A Liftmasters over the long-haul routes of K.L.M.



The growth of air freight depends entirely on reductions in ton-mile costs. In this process improved ground-handling methods will play a vital part; illustrated here is the effective system of loading and unloading Bristol 170s operated by Straits Air Freight Express (New Zealand).

This table shows an extremely detailed break-down of U.S. cargo traffic compiled in 1952 by the Research and Development Facility of the U.S. Navy and published in the March issue of *Aviation Age*:—

Commodities	Per cent of total weight handled
Clothing and dry goods	12.1
Machinery and parts	11.6
Electrical equipment	8.1
Flowers	7.1
Auto accessories and parts	6.8
Electronic equipment	6.2
Aircraft parts and accessories	5.7
Printed matter	5.4
Drugs	4.9
Luggage	3.5
Live animals, chicks, etc.	3.4
Foods	3.1
Films and photo supplies	2.9
Iron and steel articles, castings, etc.	2.5
Blood	2.4
Engines and motors	2.4
Phonograph records and radio transcripts	2.3
Advertising and display material	2.3
Hardware	2.2
Plants and nursery stock	2.2
Paper products	1.5
Unlisted or unclassified	1.4
	100.0

Reduced operating costs of new aircraft ordered for North Atlantic freighting promise to bring a sharp decrease in tariffs. There have already been clashes at I.A.T.A. rate-making meetings between operators with passenger aircraft only (who naturally desire to maintain or decrease only slightly the existing charges) and the newly equipped carriers anxious to attract new traffic.

The present rate structure applied by I.A.T.A. airlines is exceedingly complex, and covers basic rates as well as more attractive terms for specific commodities. Examples[10] follow:

London to	Commodity rates per kg, and minimum shipment in kg	Basic rate (min., 200 kg)
Amsterdam	Household utensils, 8d (100)	11d
Brussels	Furs, 8d (250)	11d
Dusseldorf	Machinery, 1s 1d (100)	1s 5d
Lisbon	Silver bullion, 2s 9d (250)	4s 0d
New York	Cutlery, 8s 8d (45); automobile parts, 9s 5d (100); live fish, 10s 5d (45)	12s 1d

Discounts are offered for bulk shipments. Because of their better knowledge of the freight market, forwarders and agents are often able to offer better rates to shippers than the airlines themselves. This is achieved when the agent groups several shipments before approaching the carrier; he can then pay himself by subtracting a percentage of the discount. These cheaper rates apply only to consignments below the "break point" of 45 kg (100 lb)—the weight at which bulk discounts are allowed by the airlines.

In relation to world airline traffic as a whole, scheduled all-freight services represent only a small proportion of the total (see table, p. 666). Timetables for such services, for example, occupy only seven pages in the current *A.B.C. World Airways Guide*, whereas passenger services occupy 208 pages.

Basic ton-mile rates applied at present for long-distance freighting are 10d (U.S. domestic), 2s 11d (North Atlantic) and 3s 6d (most international long-range routes).

The past year has seen steady progress towards improvement of airport facilities for operating, handling and overhauling aircraft. New passenger terminals, as exemplified by that under construction at London Airport (opposite page, top), will also expedite traffic. Above are approach lights and runway markings at Schiphol, Amsterdam. Opposite (centre) is shown a United Air Lines innovation at Midway, Chicago: buried power cables and fuel hoses have greatly reduced "ramp clutter" in the form of fuellers and generators. At the foot of the opposite page is part of B.E.A.'s superb engineering base at London Airport, showing the permanent dock for overhaul of Elizabethans.

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Scheduled Freight Services

Nation	Operators	No. of single trips weekly
Argentine ...	Aerolineas Argentinas	14
Australia ...	Airlines (W.A.), McRobertson-Miller ...	3
Belgium ...	Sabena	26
Brazil	VARIG	14
Cuba	C.C.A.	12
Eire	Aer Lingus	22
Honduras ...	Servicio Aero de Honduras	4
India	Indian Airlines Corporation	204
Iran	Iranian Airways	2
Israel	Arkia, El Al	6
Lebanon ...	Air Liban	10
Malaya	Malayan Airways	12
Mexico	C.M.A.	16
Netherlands ...	K.L.M.	23
Philippines ...	P.A.L.	13
Salvador ...	T.A.C.A.	1
Scandinavia ...	S.A.S.	10
Switzerland ...	Swissair	2
Turkey	D.H.Y.	14
United Kingdom	B.E.A.*	56
United States ...	American, Braniff, Capital, Delta-C. & S., Flying Tiger, National, Northwest, P.A.A., Slick, T.W.A., United	437
	Total ...	901

* In addition, B.O.A.C. operate a monthly service to Singapore.

The Growth of Air Traffic

The overall rate of expansion of scheduled air traffic—about 16 per cent per annum since the end of the war—is illustrated in tabular form on page 660. It can be better appreciated, however, by quoting some local examples of how service to the public has improved over the past five years.

This table shows the increase in both frequency and speed of service over seven well-known routes, chosen at random (details taken from the *A.B.C. Guide*):—

Distance	Route	No. of round trips weekly		Best time	
		May 1949	May 1954	May 1949	May 1954
				hr min	hr min
48	Lympne-Le Touquet ...	21	110	30	20
220	London-Paris	52	145	1 15	1 5
340	Los Angeles-San Francisco	211	301	1 45	1 40
439	Melbourne-Sydney ...	124	129	2 5	1 55
910	London-Rome	24	62	4 20	3 40
2,470	New York-Los Angeles	112	224	9 55	7 15
3,440	London-New York ...	25	42	13 30*	12 0*

* Eastbound.

Another table[11] shows how the airlines have steadily increased their share of traffic on the most important inter-zonal highway in the world—the North Atlantic Ocean:—

Year	Air passengers X 1,000*	Sea passengers X 1,000*	Total X 1,000
1948	253 (28)	637 (72)	890
1949	273 (29)	672 (71)	945
1950	317 (29)	762 (71)	1,079
1951	339 (32)	710 (68)	1,049
1952	446 (35)	844 (65)	1,290
1953	510 (36)	900 (64)	1,410

* Figures in parentheses show percentage of total traffic.

It is significant that the *total* traffic over the route has itself increased greatly, although the rate of growth for shipping traffic has been slower than for the airlines.

Still more impressive is the fact that, according to American statisticians, the United States airlines will have earned more revenue than the railways by the end of 1954.

Cautious estimates are being made of the rate at which air traffic will grow over the next decade. One American authority[12] suggests that in 1965 the U.S. domestic and international lines will be carrying about 63 million passengers, or about twice as many as in 1953.

United

De Havilland's 14/17-seat Heron feederliner has shown that the small, simple airliner can make an important contribution towards improving "outback" communications.

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Political Problems

Shortly before the end of the war the Western nations, realizing that international air traffic would be a powerful force in the post-war world, met in conference at Chicago to determine, *inter alia*, a basis for the exchange of traffic rights. There was an obvious need for a wide measure of freedom if the long-range aeroplane's powers as a bridge between nations were to be fully realized. At the same time, the idea of full freedom—the ability of any airline to fly where it chose—was unacceptable to the majority of governments, bearing in mind the possible effects on national economies of a battle for traffic between subsidized carriers.

The result of the Chicago conference was the system of Five Freedoms (illustrated on this page), which has since remained the basis of international air traffic—notwithstanding numerous attempts to produce a multilateral agreement, the latest being at Strasbourg a few weeks ago. Every nation which has signed the Chicago Convention automatically gives Freedoms One and Two to the other signatories. This is the limit of multilateralism. The remaining Freedoms are granted by means of bilateral agreements.

A typical agreement of this kind, between nations A and B, would permit:

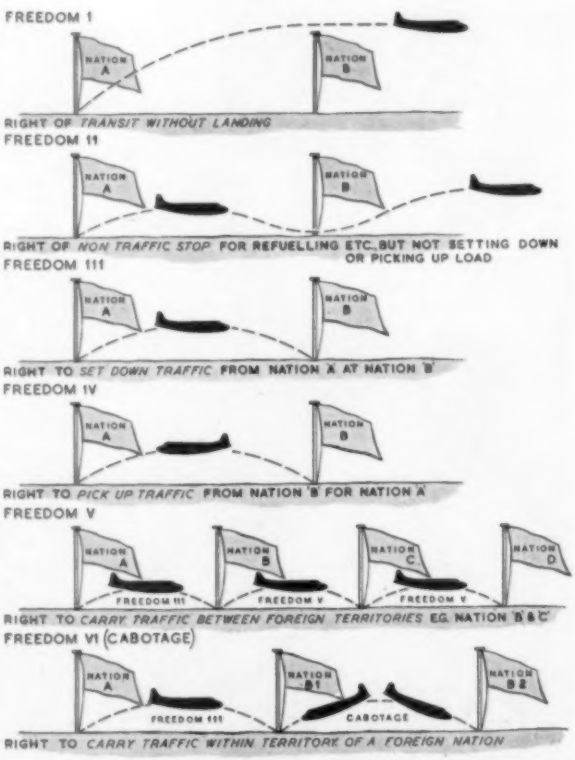
(a) Approved airlines of both A and B to carry passengers in either direction between A and B (Third and Fourth Freedoms).

(b) Either party to increase its share of capacity on routes between the two countries, up to a reasonable point, and provided that there is a genuine demand for extra capacity. (This capacity clause is designed to control competition without over-restricting the growth of traffic, and is usually worded in rather vague terms.)

(c) A measure of Fifth Freedom traffic: e.g., permission airline A to carry from C to B and B to C, or airline B to carry from C to A and *vice versa*.

There agreements are negotiated by governments on behalf of airlines. In cases where Third and Fourth Freedom traffic is divided between two operators such as B.E.A. and Air France, details of changes in frequency are normally arranged directly between representatives of the airlines. Negotiation of bilateral agreements for a long-distance service calling at, say, six different countries involves complications which are best left to the imagination. Long-haul operators are naturally anxious to obtain traffic rights on as many sectors as possible but this is sometimes impossible in the face of local desire to retain traffic for short-haul airlines.

Complex, and on occasions restrictive, as this system may be, it is the inevitable product of nationalism. Being dictated



The Heron's external neatness is matched by a bright, comfortable passenger cabin.

by political conditions which are outside the managerial sphere of air transport, it must be accepted until a better arrangement comes along.

In passing, it may be observed that exchange of traffic rights by means of bilateral agreements is sometimes one-sided.

Holland, for example, enjoys a large share of international traffic but can offer very few reciprocal rights. The Dutch population is about one-fifth of Great Britain's, but in 1953 the ton-mile output of K.L.M. was nearly 60 per cent of that for B.O.A.C. and B.E.A. combined. This fact may reflect Dutch political perseverance, K.L.M.'s commercial acumen and enterprise, relative backwardness on the part of the British airlines—or a combination of all three. To our mind, however, it does suggest that the Five Freedom concept is not quite as restrictive as some small nations profess it to be.

There is a Sixth Freedom of which comparatively little mention is made—cabotage, or the right to carry traffic within national boundaries. The major example of cabotage today is the familiar one of West Germany, which lacks sovereignty and must permit foreign airlines to operate all local services.

Under this heading the most important single question is "Are the airlines self-supporting?" To this we must reply definitely not. It has recently been estimated[13] that the 62 major international airlines last year earned £800m revenue after incurring £790m expenses, but that if allowances were made for elevated mail-pay and subsidies this profit of £10m would be turned into a £40m loss.

Furthermore, all airline calculations ignore the colossal discrepancy between the cost of building and maintaining airports and the actual contribution made by the airlines towards this cost in the form of landing fees and similar charges.

An I.C.A.O. document[14] on this subject provides some interesting figures. It is stated that during 1951 about £26m "could be regarded as that part of the cost of providing international airports properly allocable to use by international scheduled air services." Against this sum the international airlines paid nearly £7m in landing charges, while revenues from concessions, rents for office space and other services added a further £7m. The net result, from the airports' viewpoint, was a deficit of over £12m.

During the same year, it is noted, total operating costs of London Airport (including depreciation and interest), were more than £1½m. Revenues over the same period amounted to 22 per cent of this figure, and 44 per cent of the airport's maintenance and operating costs.

There is no doubt that airport deficits in many parts of the world can be cut by maximum exploitation of opportunities for letting concessions to shopkeepers, caterers and the like. But, however efficient the management, a deficit will remain with most airports for many years to come. Only small increases in charges to operators can be made without adversely affecting traffic—and the airports exist to attract and encourage traffic.

A point which deserves special emphasis is that both airports and airlines render a service to the community which is literally invaluable. Their status as part of national defence is equally intangible. Deficits at airports cannot be fairly reflected in airline operators' accounts, but they are mentioned in this study to underline the need for objective assessment of air transport. There is a tendency for profit or loss figures to be taken out of context and treated as an infallible measure of operating efficiency. There are too many hidden subsidies, too many variations in operating conditions, for airlines to be evaluated solely on a profit-and-loss basis.

The acid test is the quality and relative cost of service which the airline customer receives. In general, he gets good value for money.

Operating Costs

A break-down of the major cost items incurred by airlines will serve to indicate the direction in which future improvement can be expected.

Flight operations account for an average of about 30 per cent of most operators' expenses. This includes crews' salaries, which average about 10 per cent in America and 7-8 per cent elsewhere, crews' expenses, fuel and oil (about 15 per cent), insurance (1½-2 per cent) and remaining minor costs.

Depreciation charges vary greatly from operator to operator, depending on the period of depreciation (usually around six years) allowed and the average age of the fleet. Percentages vary from 3 to 17; but 8 per cent is probably a fair average.

Maintenance and overhaul costs normally work out at around 20 per cent.

The remainder, 40-50 per cent, is paid for station expenses, passenger services, sales and publicity and administrative costs. This proportion includes all salaries except those of flight crews.

The actual level of salaries paid is almost outside the airline's control, but the size and quality of staff (particularly administrative personnel) can be the most critical factor affecting the economic result. The employee of American Airlines, for example, is paid air transport's highest average salary (about £1,500) but he is also among the most productive in terms of ton-miles per annum. Efficient management also presupposes the existence of an aggressive sales branch capable of filling the largest number of seats possible and the last inch of cargo space.

Choice of aircraft is often described as the airline executive's biggest problem. It may be true that the wrong aircraft will put an airline "in the red" inside a very short space of time, but the majority of operators by-pass this problem by avoiding unknown quantities and choosing one of the very small number of aircraft known beyond doubt to be capable of the task in hand. In practice, the majority of traffic is carried by a handful of major aircraft-types, and the selection of equipment has caused sleepless nights only where new and revolutionary aircraft—notably the British turbine-powered airliners—are under consideration. In the case of American operators buying such aircraft as the Super Constellation, DC-6B and DC-7 the critical decision has probably centred on the number of machines to be bought rather than the type.

So far as the next generation of transport types is concerned, the operator's major contribution to efficiency is the establishment of effective liaison with designers and manufacturers. The post-war years have already seen too much expenditure on transports foredoomed to failure through lack of attention to airline requirements—or want of direction on the part of operators.

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Having ensured maximum economy in personnel, the operator's next step is to obtain, by intense utilization, the maximum output from a given aircraft fleet. The upper limit is usually set by stage-length. An exceptional annual utilization figure is 3,500 hr per aircraft; for long- and short-haul operations respectively 2,500 hr and 1,500 hr represent good averages: some actual examples of daily utilizations achieved by major airlines in 1952, as quoted in an I.C.A.O. statistical digest,[15] are shown by this table.*

Daily Utilization hr min	Aircraft	Operator
10 13	Constellation	Eastern
10 01	DC-6	National
9 17	DC-4	C.P.A.
9 04	DC-3	C. and S.
8 59	DC-4m	T.C.A.
8 42	DC-6	Braniff
7 58	DC-6B	K.L.M.
7 03	Constellation	Qantas
6 53	Argonaut	B.O.A.C.
6 34	DC-6	Swissair
5 44	Stratocruiser	B.O.A.C.
5 06	Viking	B.E.A.
4 54	DC-3	Aer Lingus
4 49	Convair 240	American

It may be concluded that there is no short cut to profitability: administrative, commercial, operational and technical improvements all play an equally important part in reducing the cost of air transport to both operator and user.

European and U.S. Air Transport

On behalf of six European airlines, a most exhaustive market survey[16] has lately been completed by the Air Research Bureau.

The Report is in many ways comparable with the findings of the much-publicized visits to America by British productivity teams. Many of the recommendations apply not only to Europe but to other regions of the world where air transport is less advanced. A summary of the Report therefore makes an appropriate conclusion to our own condensed survey.

About half the total passenger-mileage flown by the world's airlines is performed by American operators, who carry rather more than half the total number of *passengers*. Of the traffic remaining, European airlines are responsible for the largest proportion—about 30 per cent of passenger-miles and less than 20 per cent of passengers. Some two-thirds of European air passengers travel on regional routes but the passenger-mileage flown by travellers on the European intercontinental lines is more than twice the regional total.

On the basis of 1951 statistics used in the Bureau's Report, the average American flew ten times as many passenger-miles as the West European; this, clearly, was only partly accounted for by the fact that the respective average salaries for this year were £640 and £170.

On the subject of relative safety of operation, the Bureau notes that Europe shows a better safety record than the average for the whole world, but a rate below that for United States domestic traffic. Over the period 1950-1952 inclusive, comparative indices (on the basis of fatalities per 100m passenger-kilometres) were 0.59 for U.S. domestic carriers; 1.41 for U.S. international carriers; 1.75 for the six major European airlines studied in the Report; and 7.2 for all other scheduled traffic. It is concluded that so long as European domestic travel continues to increase the ratios can be expected to approach the U.S. domestic level.

Without making any false claims as to the relative safety of air travel, the Report condemns the degree of publicity given to airline accidents, which have been responsible for an average of 20 deaths a year in Europe. During 1951, it notes, passenger casualties on European railways totalled 402 killed and 2,939 seriously injured, while road accidents were responsible for 5,600 passenger fatalities with serious injuries to 38,000 more. The total number of people killed in road accidents over this period was 30,000.

Studies made of 214 airports in the United States and 41 in Europe showed that aids to bad-weather flying were provided in the following proportions: G.C.A., United States 6 per cent, Europe 22 per cent; I.L.S., U.S. 66 per cent, Europe 61 per cent; high-intensity lights, U.S. 14 per cent, Europe 37 per cent; approach lights, U.S. 50 per cent, Europe 70 per cent. In this respect, therefore, the European situation is not unfavourable.

To be competitive, air transport must offer a density of service at least as high and as well-dispersed over the day as is the corresponding road or rail service. Because of the constant policy of increasing the size and seating capacity of aircraft there was practically no increase in frequency over the average European route, the number of trips weekly varying between 4.3 and 4.6. A study of American timetables showed that even U.S. local airlines were providing a service density more than five times the average of European airlines.

From a traffic point of view, the Report concludes, the tendency to introduce big aircraft was properly justified in the United States, where, in general, the density of service had been high enough to satisfy the public demand; but the European carriers followed their example without first achieving a satisfactory average frequency. It is emphasized that American local airlines operating routes with small traffic flows still consider Convairs too large. Increase in frequency, it is suggested, will often improve utilization to an extent which offsets the lower seat-mile costs of the big aircraft.

Despite the obvious attraction of faster aircraft, the passenger's main concern is to travel between city-centres in the shortest possible time; this depends on four items: surface transport to and from the airport; handling time at the airport; ground time at intermediate stops; and flying time. Considering the last item—flying time—the Report notes that 50 per cent of European passengers are travelling on stages shorter than 250 miles. Over a 185-mile stage the difference in airport-to-airport times offered by the slowest and fastest of five types considered is only 16 minutes. On a 440-mile stage there is a difference of only 68 m.p.h. in the respective block speeds of DC-3 and DC-6, and over a 440-mile journey broken into two stages the difference drops to 41 m.p.h.

So far as transit stops are concerned the figures quoted by

A significant 1953 development was Sabena's inauguration, in August, of the world's first international helicopter services. The airline's S-55 network now covers cities in Holland, France and Germany.

* *These figures are not necessarily true for 1954: B.O.A.C.'s Argonauts, for example, are at present flying over 10 hr daily.*

Last month saw completion of the Viscount's first full year of regular passenger services. B.E.A.'s part in developing the Viscount, and thus contributing to overseas sales, is well symbolized by the background to this picture—showing the "Epicurean," arriving at London Airport.

the Report speak for themselves—an average turn-round time of 12 minutes for Convairs in U.S. domestic service over stages of 125 to 370 miles, compared with 45-60 minute stops for European Convairs operating like stages. To some extent this difference is accounted for by the paper-work involved in European international flying. City-airport travel times for Europe and America vary only slightly; the average time for Europe is 26 min for a 7½-mile journey, the corresponding American figures being 25 min and 8 miles.

Up to a distance of 500 miles more than half the passenger's time is spent on the ground. Since three-quarters of European regional passengers travel over distances of less than 500, it is concluded that reductions in ground time are, for the greater part of the traffic, more important than increased flying speed.

The following table shows the distribution of aircraft time, in hours and minutes, for two popular types of aircraft used both in Europe and America.

	Block time	Loading Unloading	Maintenance Overhaul	Time on ground	Dead time	Total
Short range: (DC-3)						
Europe	3.50	2.05	6.10	5.30	6.25	24.00
America ...	9.30	0.50	3.45	4.15	5.40	24.00
Medium range: (Convair 240)						
Europe	5.00	1.50	7.00	5.40	4.30	24.00
America ...	7.35	0.40	6.30	3.05	6.10	24.00

Since American domestic carriers fly shorter average stages than the European airlines, the U.S. machines spend more time on the ground away from base than European aircraft. Loading and unloading generally take four times longer in Europe, so there is obviously a large margin for improvement. DC-3 maintenance work is performed four times as fast in the United States; and the times taken to overhaul Convairs and DC-4s in Europe are 50 per cent longer than the corresponding times for U.S. carriers.

In terms of ton-miles per employee, comparison is again unfavourable to European airlines, the average American airline worker producing anything up to six times as much as his European counterpart.

Despite the higher salaries paid by American airlines, their total operating costs are lower than those of European operators. This is accounted for partly by the lower productivity by the European companies but also by some important factors outside the control of the airlines—notably fuel costs (about 60 per cent higher in Europe) and landing charges (two or three times higher).

In conclusion, the Report suggests that both operators and passenger will benefit from action along the following lines:

(1) Regular publication of data required for present comparison and future planning.
(2) Better equipment for the European airports.
(3) Reduction and standardization of landing fees.
(4) Reduction in the amount of paper-work required for international traffic.
(5) Relaxation of import duties on spare parts.
(6) Standardization of laws concerning personnel licensing, to permit overseas recruitment by countries short of crews and to facilitate interchange services.
(7) Airline support for the convertibility of currency.
(8) Consideration of methods of improving travel conditions; in particular, air transport would benefit by the creation of a new type of hotel.
(9) Improvements in frequency, providing at least a daily service, and a slowing-up of the trend to increase the size of aircraft on European routes. The report also notes that "When overemphasized, the requirements of fast and direct connections between internal and inter-continental services lead to bunches of departures concentrated in the morning or in the evening. Such a situation is detrimental to a correct development of intra-European traffic."
(10) Concentration on methods of improving utilization and of increasing productivity.
(11) Adaptation of fares and rates to relate them more closely to market conditions. In this connection it is urged that the price of tickets should include cost of city-airport transport.

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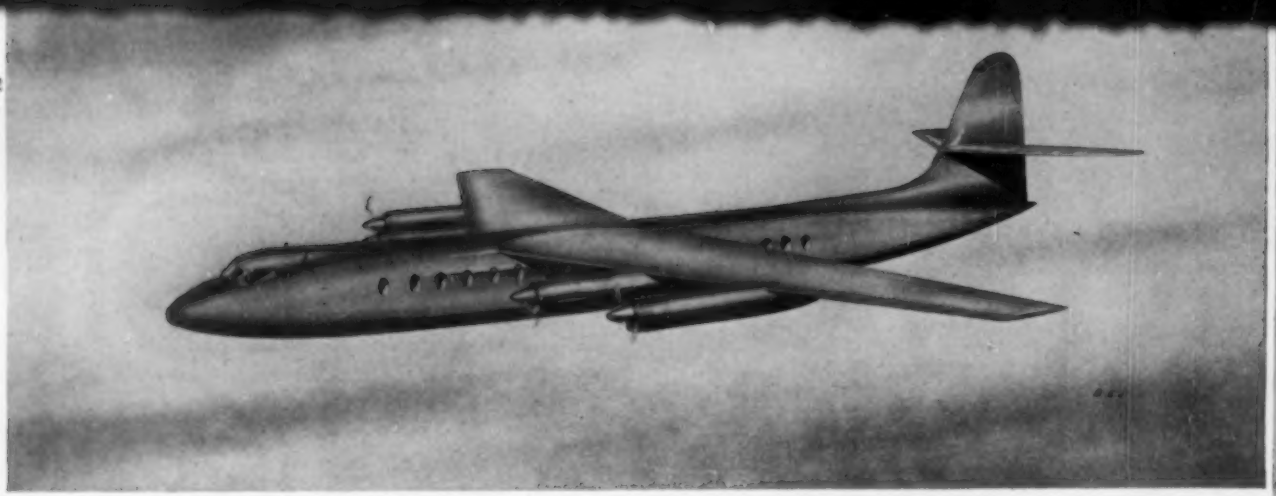


The type of transport which may become widely accepted on medium-stage routes in a few years' time. With four highly efficient two-spool turboprops of about 4,000 h.p. each, it should carry 90 passengers for about the same direct cost per mile as the present Viscount.

The Airliner of the Future

Things Seen in a 1954 Crystal Ball

By W. T. GUNSTON

WHEN probing the mists of the future, it is essential that the prophet should not allow himself to be lured into a dream world in which the hard facts of life are softened or ignored. In the present connection, it must always be borne in mind that airliners exist not for the prestige of a company or nation, but solely in order that the public services of an airline may be flown efficiently and with profit. Today no aircraft constructor remains unaware of this fact; all too often he has learned it by bitter experience, as a dozen sterile prototypes bear witness. In any case, the development of a modern airliner is so immense an undertaking that the number of firms able to complete the task can be counted on the fingers. No company, however big, can complete it without the most detailed co-operation of all interested parties, especially potential customers.

Today, most airlines are thinking very seriously about fleet re-equipment. It is ten years since the newest DC-3 was built, and even the first Constellations, Convairs and DC-6s are doubtless beginning to feel their age. More than ever before, the airlines of the world are faced with the problem of choosing the right aircraft—it *must* be the right aircraft—from many projects of unprecedented variety. Only very few of these projects will succeed; the remainder never will. In many cases, decisions will rest upon factors unrelated to the performance claimed for the new aircraft; in every case, the operator will order only when he is certain that a large number of the same type of aircraft will eventually go into world-wide service.

All new commercial aircraft must, as we have said, show that they can do what can only be described as a "useful job" while making a profit. In practice, this simple dictum cannot be applied directly; only the judgment of long experience can be relied upon to guide the operator in his choice. He will, naturally enough, conduct a careful survey of the potential performance of each new project as it applies to his own routes, and the answers to this may provide a basis for discussion. Other factors, however, cannot be ignored—among them such subjects as the financial strength of the airline company or nation, the availability of trained engineers, national prejudice or a tendency always to buy from a particular source, and the amount of competition to be expected. On top of all this is the fact that nobody will sign on the dotted line until he has satisfied himself that he will not be the only operator of the type—or even one of the only three or four. Furthermore, most airlines have very definite opinions of the calibre of each of the aircraft-manufacturing companies; and the "strength" of the company (in money, experience and tenacity), and its approach to the subject of after-sales service, will have a very great effect on the decision of whether to buy, or not.

The whole subject is so vast that the remainder of this essay is divided into sections, in each of which is analysed the needs of a particular type of airline. The first such section is concerned with the future long-range transport—what might be termed a "mainliner."

Almost the only unchanging thing about air transport is the Earth itself. Within limits, London is not getting any farther away from New York, nor is it getting any nearer. On this basis, then, some planning can be done. The earliest "global" air routes—those of our own Imperial Airways—were based on aircraft which, although they spread a fine acreage of fabric, were nevertheless puny and weak in comparison with their counterparts of today. The route to India in 1929 underlines this: London-Paris-Basle-Genoa-Rome-Naples-Corfu-Athens-Suda Bay-Tobruk-Alexandria-Gaza . . . an average of scarcely 200 miles per hop. By 1946, the Constellation began to cover the earth in 1,500-mile stages, and within very few months we shall have the Britannia, with which the operator can plan his routes while holding a terrestrial globe in the palm of his hand. With the Britannia, the airline has an aircraft with all the range needed; whatever the future holds, there seems little point in trying to fly more than 5,000 miles in one hop. (Not so the bomber; 5,000 miles may only be half the trip in this case.)

It would appear, therefore, that no transport need ever be built grossing more than 250,000 lb, or thereabouts. Any increase in size would involve all kinds of penalties—more difficult hangarage and maintenance, less frequent schedules, runway troubles, and a much less "flexible" fleet—for no apparent gain, apart from a nebulous prestige advantage.

TABLE I: SOME POWER UNITS FOR LARGE TRANSPORTS

Type	Aircraft cruising speed (m.p.h.)	Fuel and cost per gal (pence)	Weight of four installed p/plants (lb)	Spec. fuel cons. (lb/hr per h.p. or lb)	Gal. per 1,000 st. mile for four engines	Pence per mile for fuel	Pass. o'haul cost (relative)	Passenger appeal	Cruise altitude (ft)
Turbo-Compound	350	115-145 grade 33d	17,000	0.38	1,900	62.6	100	Fair	20,000
Nomad ...	200/400	Diesel oil 20d	18,000	0.34	1,500	30	80	Fair	Any
Turbojet ...	500/600	Kerosine 22d	12,000	0.80	3,500	77	80	Good	40,000
By-pass ...	500	Kerosine 22d	15,000	0.65	2,500	55	90	V. good	30,000+
Turboprop ...	400/500	Kerosine 22d	15,000	0.40	1,700	37.2	100	Good	25,000+

This places the future mainliner roughly in the 150,000 to 200,000 lb class, with span and length of about 150ft and passenger capacity of about 150.

The size having been determined, three distinct aircraft present themselves: one with compound piston engines, one with turboprops and one with turbojets or by-pass engines. It is exceedingly difficult to predict which engine will sweep the board during the next 10 years; possibly, there will be room for two. It does appear certain that, although many airlines are just beginning to know the Wright Turbo-Compound engine, no power unit will survive for long if it has to be supplied with a delicate brew of high-grade petrol.

Any analysis of the relative merits of the various available forms of power unit must take into account all the factors shown in Table I. The engines in the last three columns of this table represent gas turbines with a take-off performance of about 10,000 lb thrust, 12,000 lb thrust and 4,000 h.p., respectively; each has a combustion pressure-ratio of at least 8 : 1 and the by-pass engine divides its flow 50 : 50. All the engines listed would require top-quality maintenance and, in most parts of the world, their use would have to be preceded by extensive instruction of personnel in new skills and techniques.

Apart from the overwhelming cost advantage of the Nomad on account of its use of cheap fuel, all five engines appear much of a muchness. It should be appreciated that the comparative overhaul costs are the writer's own opinion and that the figures given pre-suppose the establishment of a representative overhaul life of at least 1,000 hours for each engine and equal utilization for all. The high figures in the first and last columns result from the cost of the airscrews and their control systems and general complexity; the competitive value in the Nomad arises from the fact that no part of this engine is called upon to work near the limits of stress or temperature (unlike all the other engines shown) and the engine has very simple controls and no valve gear or in-flight ignition.

The great variation in fuel consumption shown would naturally be reflected either in payload or in the size of aircraft for a given job. Again, the high speed of turbojet aircraft might be expected to have an effect on the structure; for a given basic size both structure weight and cost might jump at least 20 per cent during an increase in design speed from M=0.6 to 0.85, and another 20 per cent if the design were for over M=0.9. Cruising altitude will also have an effect on the airframe; both the turbojet and by-pass aircraft would probably need a pressure differential of at least 9 lb/sq in.

As regards the rest of the aircraft it appears almost certain that the accepted basic layout will continue as at present, with some possible variations in power plant position where airscrews are not used; perhaps the only basic trend to be noted is that low-wing designs will become less preponderant than they are at present. There is a particularly great scope for variation in landing gear. Conventional tricycle undercarriages with bogie main gear will probably retain their popularity, with tyre pressures becoming stabilized at about 130 lb/sq in. Alternatives to the accepted arrangements are fuselage-mounted multi-wheel gears (particularly applicable to high-wing aircraft) and tandem wheel arrangements, and there is also a more remote possibility that marine aircraft may gain in popularity, either with a planing bottom or with hydro-skis.

At present there is no sign of any general adoption of two decks and, as we have proved to our own satisfaction that there is no need for civil transports bigger than 250,000 lb a.u.w., it is doubtful whether there need be any swing away from present 12-15ft-diameter tubular fuselages. Block times should never be greater than ten hours, and presently accepted values of fuselage volume per passenger should be adequate for all future requirements. At this point a word should be said regarding the importance of really good interior design and furnishing, which pays immense dividends not only in passenger reaction but in increasing the efficiency of the aircraft as a place in which over 100 people can live for a day or more. Good-quality interior finish is essential; one can often be rudely surprised by inspecting a transport little more than a year old and finding a general aura of dilapidation, particularly around the flight deck.

Auxiliary power demands are certain to go on increasing. It is in these main services and systems that there is to be found the most prolific hunting-ground for weaknesses in present transports. Not only do trivialities cause maddening unserviceability with distressing frequency, but the whole arrangement of interior equipment will have to receive even more careful attention than has been the case in the past. Something will also have to be done to remedy the unforgivable trend on the part of some firms to show a complete disinterest in a product once it has been sold. Generally speaking, civil-transport auxiliary power systems seem to be, in conception, at least two years behind those of military aircraft of equivalent size. This is partly because a modern bomber requires more auxiliary power in a smaller space than does a transport of equal weight, but more widespread adoption of turbine-driven aircraft will probably promote the introduction of extensive low-pressure air systems extending to all parts of the aircraft and driving, *via* small turbines, all the alternators, hydraulic pumps and other units. It does appear that the present system of centralizing power generation equipment in one place is detrimental to safety and serviceability. In any case, it is generally agreed that proper electric and hydraulic power for a jet airliner cannot be obtained through a shaft drive while at idling r.p.m. on the ground.

Among aerodynamic features, modern transports are certain to require effective speed brakes, suppressed aerials and high-lift flaps. It is unwise to be dogmatic about flying control systems, but the writer is strongly of the opinion that no power should be brought into the system anywhere—not even for trimming—unless it is absolutely essential.

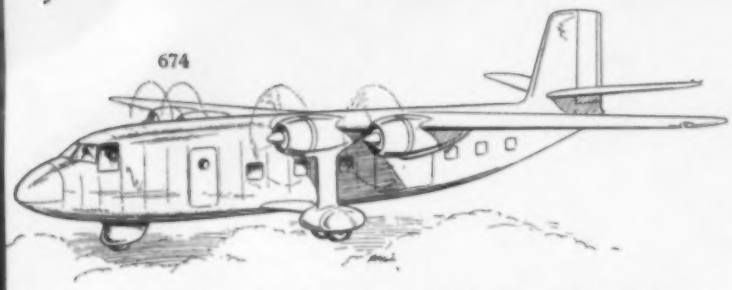
Radio is still a headache for "global" operators, and will probably remain so for some years to come. Eventually, international agreement may be reached regarding communications, navigational aids and blind-landing systems, but the present position is hopeless. Four sets, duplicated if necessary, should suffice for every all-weather requirement in every part of the globe. The equipment itself is now fair enough; after perhaps too violent a swing towards miniaturization at the end of the war, the major radio companies are now producing adequate and reliable equipment with acceptable weight and size. Suppressed aerials have had individual structural troubles but are now firmly established and give performance at least as good as can any other form of antenna.

Anti-icing systems are far from standardized. Canada recently produced a report favouring cyclic heating with electric resistance wires; other countries are adopting hot-air systems which are especially attractive if the supply can be bled from a gas turbine compressor, and other alternatives

TABLE II: CHARACTERISTICS OF PROJECTED "MAINLINERS"

Aircraft	Eng.*	Total s.h.p. or thrust	Wing posn.	Seats (max.)	Span (ft)	a.u.w. (lb)	Typical cruise (m.p.h.)	Max. payload (lb)	Full-load range	Field length (ft)	Approx. pence/ t.m.	Approx. first cost (£ X 1,000)
Avro Atlantic	4J	40,000+	L	131	121	200,000	600+	45,000	1,500+	6,000	7-10	1,000+
"Super Britannia"	4T	—	L	100+	—	180,000+	450+	40,000+	5,000	—	6-8	1,000+
H.P.97	4J	40,000+	M	150	—	—	550+	50,000	2,200+	—	—	1,000+
V.C.7	4B-P	40,000+	L	150	140	180,000+	550+	—	—	—	—	1,000+
Stratoliner	4J	40,000	M	130	130	190,000	550	31,500	3,000	8,000	8-10	1,700+
DC-8	4J	36,000	L	100	114	158,000	570	30 000	1,200	8,000	—	1,500+
Fairchild M-186	2J	24,000	H	64	100	75,770	570	35,000	2,500	5,630	9	1,000+
Lockheed L-193	4J	48,000	L	100	155	260 000	564	—	3,500	5,000	—	2,000+
H.D.45	2J	20,000	H	80	148	90,600	453	17,600	1,860	5,000	7-8	500+

*In Col. II, J, T and B-P signify turbojet, turboprop and by-pass engines, respectively. The values given above are based on those published by the manufacturer or by foreign journals and are, of necessity, approximations.



A simple four-engined design of this general configuration might be the optimum solution for many of the smaller airlines now seeking new flying equipment. The aircraft shown has four Leonides, but turboprops would interest operators in some countries.

THE AIRLINER OF THE FUTURE . . .

include pulsating rubber strips, sprayed-on electric elements or porous sheet transmitting either a liquid or hot air. Probably about 50 per cent of the world's transports will not require any ice protection whatsoever.

Other general trends include the adoption of heavier-gauge sheeting for the major stressed portions of the airframe, the use of very thin sheet on lightly stressed parts, stabilized with a honeycomb or foam-type filler, and—if only for the sake of appearance—flush riveting throughout. (While on the subject of appearance, transports cruising faster than M=0.8 are likely to demand unusual types of paint for all exterior applications.) There does not appear to be any economic justification for extensive integral construction in any civil aircraft; on the other hand, jigging and tooling must be sufficient to ensure absolute interchangeability between corresponding parts of every aircraft of a given type.

So much for the mainliner. There remains to be considered the problem of suitable aircraft for the operators of the 1,000-plus DC-3s still on scheduled service. This would be a huge market for any suitable aircraft.

It must at once be appreciated that nothing built today can "replace" the DC-3 in the normal sense of the word, for this remarkable aircraft was usually purchased under such unusual war-surplus conditions as to render the costing of the airline over the succeeding years almost farcically unrepresentative of what might be termed normal practice. Thus, a new airliner of this size might cost as much as a dozen or fifteen DC-3s, most of which have been written off their owners' books years ago. Purchase price will govern the acceptance of any new aircraft in this category. Most small countries today simply cannot afford fleets of any of the eight or nine aircraft in this class at present projected or flying in prototype form; in fact, we believe that a ceiling of about £60,000 will have to be placed on the first cost.

The best size for universal acceptance appears to be 20 to 25 seats, i.e., about the same capacity as the DC-3. Table II shows the possible characteristics of such an aircraft in comparison with whatever values are available for the "DC-3 replacements" at present being studied. Our cheap suggestion is shown in two forms, differing in their power plant, and some words of explanation are due on this point.

Most highly developed airlines will undoubtedly prefer the gas turbine aircraft; in fact, those with any experience of the new prime mover would probably not consider a piston-engine machine for a moment. On the other hand, the learning of new skills and the general consolidation and spread—albeit with some dilution—of turbine techniques, is sure but unavoidably slow. Piston engines are understood everywhere, and this is an overwhelming advantage to all operators in outback areas. At the present time no suitable turboprop exists; the best piston engine appears to be the efficient and well-established Alvis Leonides.

The choice of four engines has been dictated solely by the behaviour of the aircraft in the engine-out case and during loss of power while operating from short fields. For a given total power four engines are more expensive than two, both to buy and to maintain, yet this is of minor consequence in comparison with the possible gains in overall performance and in compliance with I.C.A.O. requirements. The adoption of a high wing is not significant, but does appear to give a better overall layout.

Every part of the design reflects the insistence on simplicity as a prerequisite to low first cost—with the probability of considerable gains in maintenance cost and the incidence of unserviceability. Even the airframe itself is exceptionally simple and exemplifies the compromise made in which rather more sacrifices have been made in performance than is usual. The fixed undercarriage is a case in point, although some operators might disagree with this choice. High cruising speed is, generally, of almost insignificant value for stage lengths below 500 miles, and a reduction of 30 or 40 m.p.h. would probably have very little effect on the overall time between city centres. This argument does not apply where the operator is experiencing severe competition.

The interior of the hypothetical transport would have a size and shape suitable for carriage of all kinds of freight, which could be loaded through large doors, or possibly through a hinged nose or tail section. The fact that the cabin is unpressurized—even in the turboprop version—permits a cheap, light rectangular fuselage section and unusually large windows. Seating would be arranged two-and-one, with the seats folding against the side wall when the aircraft is converted for freight. The design of the front-end is extremely important; few operators will be prepared to purchase a transport needing a flight crew in excess of two. Whatever radio is carried must be remotely controlled from the cockpit; in this connection a very great deal depends upon the ground navigational and airfield aids available, and whether the aircraft will be called upon to work at night or in bad weather. In most parts of the world it should be quite possible to operate under v.f.r. conditions with a flight crew of one.

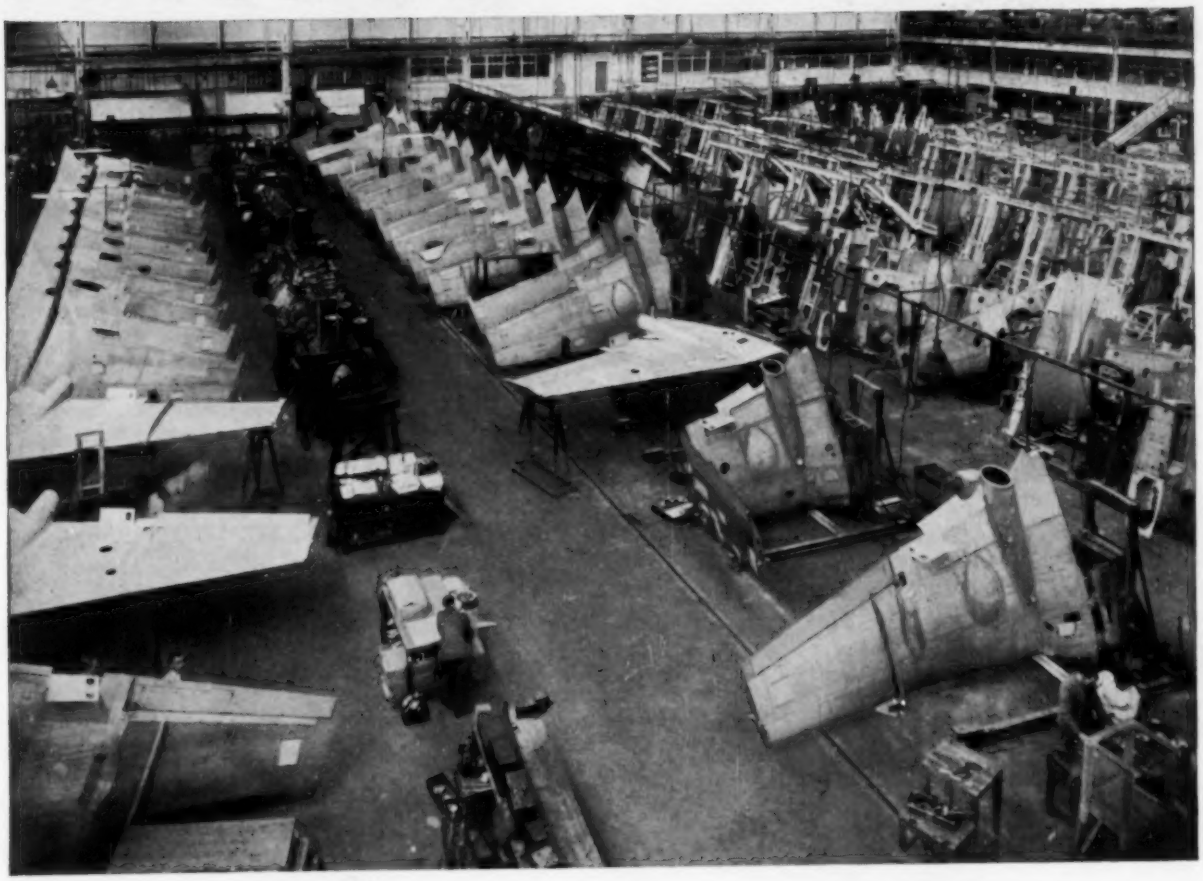
The final type of aircraft which appears to be needed is a good transport helicopter. Much was said on this subject in our issue of March 12th last, and we would only reiterate the fact that on many routes it is certain that future rotary-wing aircraft will more than equal the cost-per-ton-mile figures of the best fixed-wing aircraft. Past experience on the four-to-five-seat helicopters is quite unrepresentative of what will shortly be possible. Furthermore, if the operator is prepared to forego vertical take-off and accept a machine capable of operation from a 500-yard grass strip, an exceptionally competitive aircraft begins to materialize. A "runway" of this nature could be established quite cheaply near the centre of most cities and the steep climb of a winged helicopter would enable such an aircraft to reach 200 or 300ft altitude at take off before arriving over a built-up area. This appears to solve the problems of noise, and engine failure at take-off, the latter case being provided for by the possibility of standard accelerate-stop procedure. Such an aircraft, with an all-up weight of about 30,000 lb and perhaps 40 passenger seats should be an exceptionally useful vehicle capable of efficient operation on some of the world's busiest traffic routes.

TABLE III: CHARACTERISTICS OF AIRCRAFT DESIGNED TO REPLACE THE DC-3

Aircraft	Eng.*	Total s.h.p.	Wing posn.	Seats	Pressurized	Approx. Span (ft)	Approx. a.u.w. (lb)	Typical cruise (m.p.h.)	Full-load range	Field length (ft)	Approx. pence/t.m.	Approx. first cost (£×1,000)
DC-3	2P	2,400	L	21-8	No	95	28,000	170	300	3,630	—	—
H.D.32	2P	2,400	H	42	No	149	39,672	170	320	3,000	11½	About 140
CL-21	2P	1,600	H	32	Yes	102	32,500	215	400	3,500	13	200
F.27	2T	3,380	H	28	Yes	95	32,630	270	400	3,800	12	141
P.87 development	2T	—	H	30	Yes	92	25,000	265	330	2,700	12	110
Accountant	2T	3,080	L	33	Yes	64	21,000	288	—	3,300	12	80
H.P.R.3	4P	3,480	H	44	Yes	95	33,500	200	350	3,000	15½	115
Designs suggested by author	4P	2,200	H	24	No	75	20,000	160	400	2,700	—	60
	4T	2,800	H	24	No	75	20,000	240	200	2,700	—	65

* "T" and "P" respectively represent turbine and piston power.

FOLLAND CAPACITY



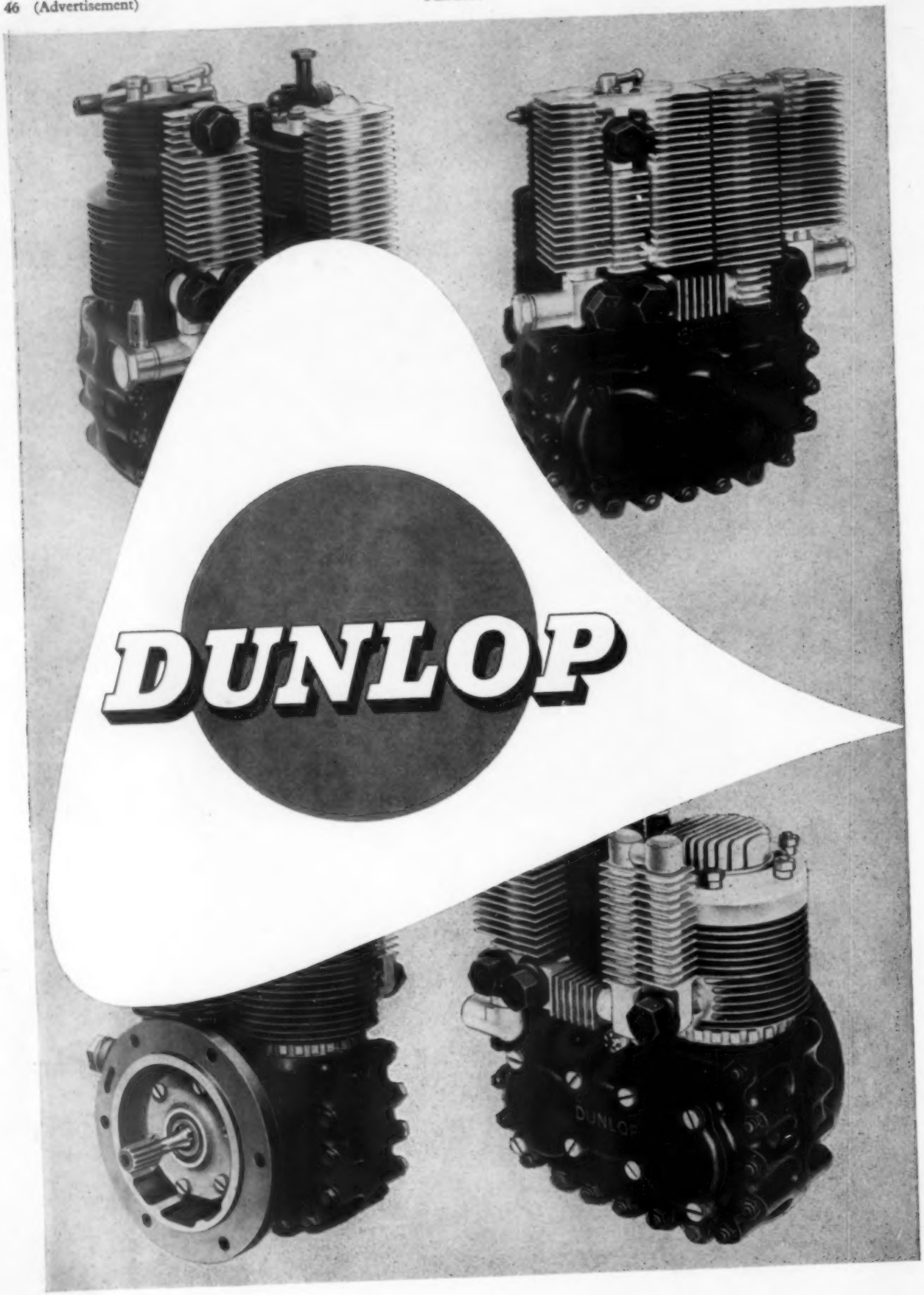
The Folland factory is laid out for p·r·o·d·u·c·t·i·o·n.

An idea of its output potential can be gleaned from the above photograph of part of the wing assembly shop.

This is one of a series of announcements depicting the productive resources of

FOLLAND

FOLLAND AIRCRAFT LIMITED · HAMBLE · HAMPSHIRE


DUNLOP
DUNLOP

ACTUATION PROBLEMS CREATED BY JET AIRCRAFT DESIGNS

High Pressure Pneumatics the Solution

With aircraft design continuing to advance rapidly, aided by the development of jet and prop-jet power units, designers of actuating equipment have been faced with a succession of new and involved problems.

Aeroplanes have taken new shapes. They have become heavier and faster. Weight of landing equipment has increased while the space available for retraction gear remains severely restricted.

These difficulties can only be overcome by designing actuators capable of meeting the more arduous conditions yet remaining relatively light in weight and small in size. Similar problems result from the increase in the loads imposed on dive brakes and flaps.

Low Temperatures

In addition, operation of aircraft in extremely low temperatures demands that the medium for operating the aircraft services must remain substantially unaffected by extreme cold and be quick to respond to the working of the controls.

Investigations have shown that a high pressure pneumatic system based on a storage pressure of 3000 p.s.i. with actuators operating at working pressures up to 1250 p.s.i. not only meets the greater demands made upon it, but actually shows a considerable saving of weight over comparable systems using lower pressures.

New Compressors

The Dunlop Aviation Division, pioneer of high pressure pneumatic actuation, is now producing a complete range of components for use in a 3000 p.s.i. storage pressure system. The system is based upon a range of 3000 p.s.i. air compressors for use in jet and piston-engined aircraft.

The Mark I is a three-stage compressor designed to take advantage of jet engine supercharging, weighs only 9½ lb. and delivers 2½ cu. ft. free air per minute.

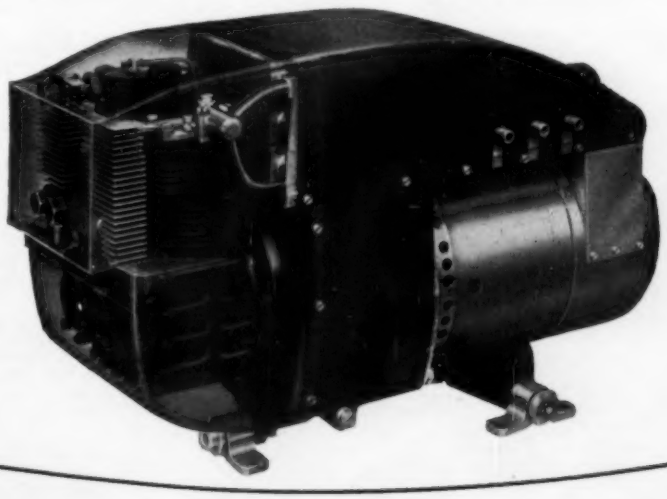
The Mark II is a development for large bomber or airliner pneumatic systems, and for the latest gas turbine starters. Air for supercharging is drawn from the pressure tapping on the engine blower casing and requires only 20 p.s.i. instead of the Mark I's 30 p.s.i.

Third in the Dunlop range is the normally-aspirated air compressor for piston engine or turbine aircraft which cannot supply supercharging air.

Self-Contained Pneumatic Supply

For constructors who require units that are self-contained Dunlop compressors can be supplied with a 24 volt electric motor drive. The 3½ h.p. motor drives the compressor through a 1.8-1 reduction gear box. An oil pump in the bottom of the gear box supplies lubricating oil to the compressor and gears. The unit is complete with precooler and boost line reducing valve. Cooling air passes over the compressor in the same way as in the engine driven unit.

A starter control complete with pressure operated switch stops the motor when the storage pressure of 3300 p.s.i. is reached and restarts the motor when the pressure is lowered to 3000 p.s.i.

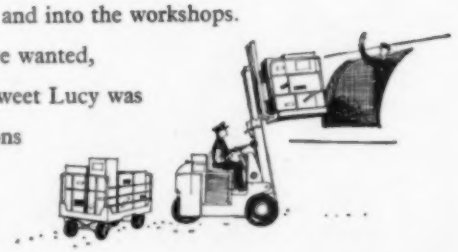


Dunlop makes things better for everyone

410/611

SWEET LUCY WILL WIN US THE 1960 AIR RACE

In the field of civil aviation, Britain is today well ahead. Thank the brilliant men who have designed, made and flown our great new aircraft for that. But thank as well Sweet Lucy, an unspectacular flier, for making sure that things *stay* that way. How? Simply by flying to the start of an important race by BEA air freighter. Her fare (pity she doesn't know it) helps to take the world-beating airliners of the future off the drawing boards and into the workshops. And helps the British airlines to send their experts, when they're wanted, to these workshops with practical help and advice. Of course, Sweet Lucy was only one among many. Last year alone BEA flew over 14,900 tons of freight and 1½ million passengers. And the more there are this year the better it will be for British flying.



freight

fly British keep British aircraft ahead fly BEA

BRITISH EUROPEAN AIRWAYS

A Directory to Companies Currently Engaged in Scheduled Air-transport Operations

"Flight" photograph

Early afternoon at London Airport, with the S.A.S. DC-6 "Harald Viking" about to leave on the two-class service to Stavanger and Oslo.

THE WORLD'S AIRLINES

THE entries comprising the following directory represent the vast majority of airlines at present engaged in the operation of scheduled services (including scheduled freight-runs) throughout the world. In 1953 these companies carried approximately 52 million passengers.

There are two main sub-divisions, the first covering major carriers (all of whom are at present performing at least ten million revenue ton-miles annually), and the second showing all other known operators of scheduled passengers, mail and freight services. (British "independent" operators, many of whom operate scheduled services in addition to charter and other occasional flights, are listed separately on pages 679-681.) In most instances the particulars are confined to the name of the operator, headquarters, sphere of operations and details of the fleet in use, and aircraft on order. For the larger foreign carriers, however, and for the British Corporations, we have added selected traffic figures as an indication of the relative extent of activities. The directory is based on the latest available information and forms a valuable supplement to the principal feature of this issue—the study of Air Commerce appearing on pages 660-671.

MAJOR CARRIERS

Aer Lingus Tta. (Irish Air Lines), Dublin (Associate of B.E.A.).—Operates services between Dublin and Shannon and from Ireland to England, Scotland, Isle of Man, Wales, Channel Islands, France and Holland. Fleet: four Vickers-Armstrongs Viscounts, 13 Douglas DC-3s and four Bristol 170s.

Aerolineas Argentinas (Argentine Airlines), Buenos Aires.—The principal Argentine airline operating domestic services and to West Africa, Portugal, Spain, Italy, France, Germany, Holland and United Kingdom. Fleet: six Douglas DC-6s, six DC-4s, 20 DC-3s, five Convair 240s and six Short Sandringhams.

Air France (Compagnie Nationale Air France), Paris.—Operating one of the largest route-mileages in the world with European network, services to North and South America, throughout Africa, to the Near, Middle and Far East and Australia. Fleet: three de Havilland Comet 1As, six Vickers-Armstrongs Viscounts, 21 Lockheed Constellations, ten Super Constellations, 25 Douglas DC-4s, 39 DC-3s, eight Breguet Provence and Junkers-Ju 52/3ms. On order: six Comet 2s, six Viscounts, four Provences, three Super Constellations and 24 Hurel-Dubios H.D.32s.

Air-India International Corporation, Bombay.—The Indian international long-distance airline linking India with Egypt, Italy, Switzerland, France, Germany, the United Kingdom, Aden and East Africa. Soon to open services to Singapore, Hongkong and Tokyo. Fleet: four Lockheed Constellations and two Super Constellations. On order: three de Havilland Comet 3s and three Super Constellations.

Alitalia (Aerolinee Italiane Internazionali), Rome. (Associate of B.E.A.).—Operates services between Rome and Turin and from Italy to Libya, France, Switzerland, Greece, the Lebanon, Egypt, Portugal, Venezuela, Brazil, Uruguay, Argentina, Sudan and East Africa. Fleet: three Convair 340s, four Douglas DC-6Bs and four DC-4s.

American Airlines, Inc., New York City.—Operates extensive system from Eastern seaboard to California with services extending south to Mexico City. This airline carries over 5,000,000 passengers a year. Fleet: 25 Douglas DC-7s, 78 DC-6s, 14 DC-4s and 76 Convair 240s.

Avianca (Aerovias Nacionales de Colombia S.A.), Bogota. (An affiliate of Pan American World Airways.)—Operates in South America and from South America to Jamiaca, the U.S.A., Bermuda, Azores, Spain, France, Portugal and Germany. Fleet: two Lockheed Constellations, 11 Douglas DC-4s, 40 DC-3s, five C-46s and one Canso. On order: three Lockheed Super Constellations.

Australian National Airways Pty., Ltd., Melbourne.—Extensive network in Australia, linking Melbourne, Sydney, Brisbane, Hobart, Adelaide, Perth and other points. Fleet: two Douglas DC-6s, eight DC-4s, 28 DC-3s and three Bristol 170s.

Braniff International Airways, Dallas, Texas.—Routes in the U.S.A. extending from Minneapolis-St. Paul and Chicago south to Gulf cities and through Cuba and Central America to Brazil and Argentina. Fleet: nine Douglas DC-6s, seven DC-4s, 24 DC-3s and 23 Convair 340s.

British European Airways, London.—Responsible for operation of main British domestic services and services between United Kingdom and European destinations, B.E.A. carries well over 1,500,000 passengers a year and was the first to operate turboprop aircraft. Fleet: 20 Vickers-Armstrongs Viscounts, 20 de Havilland-Airspeed Ambassadors, 38 Pionair-class Douglas DC-3s, eight Leopard (Dakota) freighters, 18 Vickers-Armstrongs Vikings, eight de Havilland Dragon Rapides, three Bristol 171 helicopters, two Bell 47 helicopters and one Sikorsky S-51. On order: six Viscount 701s and 12 Viscount 800s, with option on further eight.

British Overseas Airways Corporation, London.—Responsible for operation of main British long-distance services, B.O.A.C. flew over 142,000,000 traffic ton-miles in the financial year 1953-54, and secured a net surplus of just over £1,000,000. Fleet: seven de Havilland Comets, ten Boeing Stratocruisers, 11 Lockheed Constellations, 22 Canadair Four Argonauts and five Avro York freighters. On order: 12 Comet 2s, five Comet 3s and 30 Bristol Britannias.

Canadian Pacific Airlines, Ltd., Vancouver.—Routes in Eastern and Central Canada and from British Columbia and Alberta to the north. Trunk routes: Vancouver-Honolulu-Fiji-Auckland-Sydney; Tokyo-Vancouver and Hongkong-Tokyo-Vancouver-Mexico City-Lima. Fleet: four Douglas DC-6Bs, four DC-4s, 15 DC-3s, five Convair 340s and smaller types. On order: four de Havilland Comet 3s.

Capital Airlines, Inc., Washington, D.C.—Extensive route network in Eastern, Southern and Mid-Western States. Fleet: 12 Lockheed Constellations, 25 Douglas DC-4s and 25 DC-3s.

Colonial Airlines, Inc., New York City.—Routes in the Eastern States, to Canada and Bermuda. Fleet: five Douglas DC-4s and eight DC-3s.

Passengers disembark from a Braniff International Airways DC-6 at Lima Airport, an intermediate point on the Braniff routes from Miami to Buenos Aires and Rio de Janeiro.

THE WORLD'S AIRLINES . . .

Compañia Cubana de Aviación, S.A. (Cubana), Havana.—Domestic services and to Guatemala, Mexico, Salvador, the U.S.A., Bermuda, Azores, Portugal, Spain and Haiti. Fleet: three Lockheed Constellations, six DC-3s, one C-46 and one Stinson. On order: two Super Constellations.

Continental Airlines, Inc., Denver.—Routes from Denver to Kansas City and St. Louis in the east, San Antonio and El Paso in the south with through-aircraft service to California and Houston. Fleet: two DC-6Bs, seven Convair 340s, ten DC-3s and one Convair 240 and one DC-6B on lease.

Delta C. & S. Air Lines, Atlanta, Ga.—Operating from Chicago in the north to Houston and Miami in the south with international routes to Cuba, Jamaica, Haiti, Dominican Republic, Puerto Rico and Venezuela. Fleet: Douglas DC-7s (to total ten), seven DC-6s, 21 DC-3s, 20 Convair 340s, and six Lockheed Constellations.

Eastern Air Lines, Inc., New York City.—Operates extensive network in Eastern States and services to Mexico City and Puerto Rico. E.A.L. carried over 4,750,000 passengers in 1952. Fleet: 29 Lockheed Super Constellations, 19 Constellations, 60 Martin 4-0-4s and 12 Douglas DC-4s. On order: 12 DC-7s.

El Al (Israel Airlines Ltd.), Tel Aviv.—Transatlantic services *via* Greece, Italy, Switzerland, France and United Kingdom; European services to Turkey, Greece, Italy and Austria and African route to Nairobi and Johannesburg. Fleet: three Lockheed Constellations and five Curtiss C-46s.

Iberia (Lineas Aereas Españolas), Madrid.—European services, Spanish domestic services and to South America, Cuba, Mexico, Canary Is. and Spanish West Africa. Fleet: six Douglas DC-4s, 16 DC-3s, four Bristol 170s, three D.H.89s and two Junkers-Ju 52/3ms. On order: three Lockheed Super Constellations.

Indian Airlines Corporation, Calcutta.—Responsible for the operation of Indian domestic services and services to Pakistan, Ceylon, Burma, Nepal and Afghanistan. Fleet: three Douglas DC-4s, 77 DC-3s, 12 Vickers-Armstrongs Vikings and some smaller aircraft.

K.L.M. (Koninklijke Luchtvaart Maatschappij N.V.—Royal Dutch Air Lines), The Hague.—European, West Indies and New Guinea networks and routes from Europe to North and South America, South Africa, the Middle and Far East and Australia.

"Flight" photograph

Fleet: 13 Lockheed Super Constellations, ten Constellations, seven Douglas DC-6Bs, two DC-6As, six DC-6s, ten DC-4s, 11 DC-3s, eight Convair 340s, eight Convair 240s, one D.H.89 and one Auster.

L.A.I. (Linee Aeree Italiane, S. p. A.), Rome.—Operates domestic routes and to Israel, France, Spain, Switzerland, Greece, Turkey, Tunisia, Germany, Egypt, and the U.S.A. Fleet: three Douglas DC-6s, 20 DC-3s and four Convair 240s. On order: three DC-6Bs.

National Airlines, Inc., Miami.—Operating network through the Eastern States from New York south to Miami and Havana. Services operate west to New Orleans. Also Miami area helicopter services. Fleet: four Douglas DC-7s, 12 DC-6s, eight Convair 340s, 11 Lockheed Lodestars and Sirkorsky S-55s.

New Zealand National Airways Corporation, Wellington.—Domestic routes and to Norfolk Island. Fleet: 24 Douglas DC-3s, four de Havilland Herons, six D.H. 89s and three D.H. Fox Moths.

Northeast Airlines, Inc., Boston.—Serving New York, Montreal and New England. Fleet: 12 Douglas DC-3s and seven Convair 240s.

Northwest Airlines, Inc., St. Paul, Minnesota.—Transcontinental U.S. network and to Honolulu, Alaska, Japan, Korea, Formosa, Hongkong and Manila. Fleet: ten Boeing Stratocruisers, four Douglas DC-6s, 19 DC-4s and eight DC-3s.

Panagra (Pan American-Grace Airways, Inc.), New York City. (Associate of Pan American World Airways), Route network in South America extending north to Miami. Fleet: two Douglas DC-6Bs, six DC-6s, three DC-4s and ten DC-3s. On order: five Douglas DC-7s.

Pan American World Airways, Inc., New York City.—Operating a worldwide network with over 60,000 miles of unduplicated routes. P.A.W.A. carried over 1,500,000 passengers in 1953. Fleet: 27 Boeing Stratocruisers, 45 Douglas DC-6Bs, 27 DC-4s, seven DC-3s, eight Lockheed Constellations and 13 Convair 240s. On order: seven DC-7Bs and three D.H. Comet 3s.

Qantas Empire Airways, Ltd., Sydney. Australia's international airline operating domestic and Pacific regional services in addition to its trunk Kangaroo route to the United Kingdom, its Wallaby service to South Africa and routes to the Philippines, Hongkong and Japan. Q.E.A. has recently taken over the operation of the B.C.P.A. trans-Pacific route to Vancouver. Fleet: eight Lockheed Super Constellations (in course of delivery), six Constellations, five Douglas DC-4s, 13 DC-3s, four Short Sandringhams, four Convair Catalinas, four D.H. Drovers and five D.H. Dragons.

Sabena (Société Anonyme Belge d' Exploitation de la Navigation Aérienne—Belgian Airlines), Brussels.—Operating European and Congo networks and services from Belgium to the U.S.A., Libya, Morocco, Nigeria, Belgian Congo, South Africa, Egypt, Sudan and Uganda. Also operating European helicopter services. Fleet: eight Douglas DC-6Bs, five DC-6s, seven DC-4s, 23 DC-3s, four Convair 240s, three Sikorsky S-55s and some smaller aircraft. On order: eight DC-6Bs and one DC-6A.

Scandinavian Airlines System, Stockholm.—Comprises Danish, Norwegian and Swedish Air Lines. Operates domestic services in Denmark, Norway and Sweden, a European network and long-distance routes to North and South America, South Africa and the Far East. S.A.S. is pioneering Polar routes. Fleet: 14 Douglas DC-6Bs, 12 DC-6s, four DC-4s, ten DC-3s, six Saab Scandias and two Junkers Ju 52/3m floatplanes. On order: two Scandias. S.A.S. may order DC-7s.

Servicos Aereos Cruzeiro do Sul, Ltda., Rio de Janeiro.—Domestic services and to the Argentine. Fleet: 35 Douglas DC-3s and some smaller aircraft. On order: four Convair 340s.

South African Airways, Johannesburg.—Operating services in the Union and to the Rhodesias, Kenya, Portuguese East Africa, Uganda, Sudan, Egypt, Greece, Italy, Germany and United Kingdom. Fleet: four Lockheed Constellations, seven Douglas DC-4s, three DC-3s and 11 Lockheed Lodestars.

Swissair (Swiss Air Transport Co.), Zürich.—Operating European services and to the Near East, North and South America. Fleet: six Douglas DC-6Bs, three DC-4s, 12 DC-3s, seven Convair 240s, and one DC-3 freighter.

T.A.I. (Compagnie des Transports Aériens Intercontinentaux), Paris.—Operating services from France to French Indo-China, Madagascar and French West Africa. Fleet: three Douglas DC-6Bs and three DC-4s. On order: three DC-6Bs.

The arrival of the Pan American World Airways' Stratocruiser "Clipper Yankee" at London Airport. Stratocruisers operate the P.A.A. "President Special" and the B.O.A.C. "Monarch" North Atlantic services.

At the most important airport in Europe 3 out of every 4 aircraft are fuelled exclusively by . . .

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Now being fitted to "Pionair" fleet

BEA tested the Goodyear single-disc brake intensively, and reported its operation as "excellent". The tests, which were completely independent, fully confirmed data previously provided by Goodyear.

- *Approximately 1,000 landings between change of lining or adjustment.*
- *Automatic adjustment makes 'snatch' impossible.*
- *Greater heat dissipation.*
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- *Simpler maintenance: there are fewer working parts.*
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Furthermore, the wheels and brakes on the aircraft weigh less, they will have longer life. As a result of these findings, BEA are now fitting their 'Pionairs' with Goodyear single-disc brakes.

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THE WORLD'S AIRLINES . . .

T.E.A.L. (Tasman Empire Airways, Ltd.), Auckland.—Routes linking Australia and New Zealand and from New Zealand to Fiji and Chatham Island. Fleet: three Douglas DC-6s and five Short Solents.

Trans-Australia Airlines, Melbourne.—Operating an extensive Australian network with over 25,000 miles of routes. Fleet: five Convair 240s, three Douglas DC-4s, 22 DC-3s, six D.H. Drovers and four D.H. Dragons.

Trans-Canada Air Lines, Montreal.—Operating extensive Canadian network including transcontinental routes and routes to U.S.A., Bermuda, Barbados, Trinidad, Bahamas, Jamaica, Mexico and Europe. Fleet: eight Lockheed Super Constellations (in course of delivery), 22 Canadair Four North Stars, 27 Douglas DC-3s and three Bristol 170s. On order: 15 Vickers-Armstrongs Viscounts.

Trans World Airlines, Inc., Kansas City.—Extensive U.S. network including transcontinental routes and world network to Europe, Middle and Far East. T.W.A. carried over 3,000,000 passengers in 1953. Fleet: ten Lockheed Super Constellations, 68 Constellations, 40 Martin 4-O-4s, 12 Martin 2-O-2s, 13 DC-4s and 13 DC-3s.

U.A.T. (Union Aéromaritime de Transport), Paris.—Operating services from France to Libya, Cameroons, French Equatorial Africa, South Africa, French Guinea and French Ivory Coast. Also African local services. Fleet: two de Havilland Comet 1As, two Douglas DC-6s, four DC-4s, one DC-3 and six de Havilland Herons. On order, three Comet 2s.

United Air Lines, Inc., Chicago.—Operating transcontinental network and to Honolulu and Vancouver. U.A.L. carried nearly 4,000,000 passengers in 1953. Fleet: six Boeing Stratocruisers, 21 Douglas DC-6Bs, 43 DC-6s, 23 DC-4s, 34 DC-3s and 40 Convair 340s. On order and in course of delivery 25 DC-7s.

Western Air Lines, Inc., Los Angeles.—Network of services in Western States and to Edmonton, Minneapolis-St. Paul and Rochester. Fleet: four Douglas DC-6Bs, five DC-4s, nine DC-3 and ten Convair 240s.

"Flight" photograph

Passengers for Switzerland go aboard the Swissair DC-6B "Basel" at London Airport. DC-6Bs are used on the company's Super Swiss service to Zürich, as well as on the North Atlantic route.

OTHER SCHEDULED OPERATORS

Aden Airways, Ltd., Aden. (Owned by B.O.A.C.) Operates some 6,000 miles of routes in Arabia, Africa and Near East with 6 DC-3s.

Aeroflot, Moscow. The Soviet national airline. Routes throughout U.S.S.R. and to bordering countries with IL 12s, DC-3 type and other aircraft.

Aeronaves de Mexico, S.A., Mexico City. Operating domestic routes with DC-3s, DC-4s and Convair 340s.

Aero Nord Sweden A.B., Stockholm. Newspaper and limited domestic passenger services with Lodestar and Consul.

Aeronorte (Empresa de Transportes Aéreos Norte do Brasil, Ltda), Sao Luiz. Services in North Brazil with Percival Princes.

Aero O/Y—See Finnair.

Aerovias Brasil (Empresa de Transportes Aerovias Brasil, S.A.), Rio de Janeiro. Domestic services and routes to Dominican Republic, Trinidad, Venezuela and U.S.A. DC-4s, DC-3s and C-46s.

Aerovias Guest—See Guest Airways.

Aerovias "Q"—See "Q" Airways.

Aerovias Reforma, S.A., Mexico City. Domestic routes with DC-3s.

Aerovias Transcontinentales, S.A., Mexico City. Domestic routes with DC-3s.

Aigle Azur, Paris. Services to Indo-China, French Equatorial and West Africa and Madagascar with Boeing Stratoliner.

Air Atlas—Air Maroc (Compagnie Chérifienne de Transports Aériens), Casablanca. Services in North Africa and to France, Italy and Switzerland with DC-3s, DC-4s and Bretagne.

Air Ceylon, Ltd., Colombo. Services to India with DC-3s.

Air Jordan, Amman. Local services and between Jerusalem and Kabul with DC-3s.

Air Laos, Vientiane. Local services with DC-3s and Bretagne.

Air Liban, Beirut. Services in Near East with DC-3s and Languedoc.

Airlines (W.A.), Ltd., Perth. Services within Western Australia with Doves.

Airtaxco, A.B., Stockholm. Newspaper and limited domestic passenger services with Lockheed twins.

Air Vietnam, Saigon. Local services and to Hongkong and Thailand. DC-3s, DC-4s and Bristol 170.

Alaska Airlines, Inc., Anchorage. Domestic routes and to U.S.A. DC-3s, DC-4s and other types.

Alaska Coastal Airlines, Juneau. Local services with Grummans and Canso.

Allegheny Airlines, Inc., Washington, D.C. Eastern States feeder line with DC-3s.

Ansett Airways, Pty., Ltd., Melbourne. Network of DC-3 services and Sandringham services to Hayman Is., Hobart and Lord Howe Is.

Arab Airways (Jerusalem), Ltd., Amman. (Associate of Aden Airways.) Routes from Amman to neighbouring countries and to Aden with DC-3s.

Arctic Wings, Ltd., Churchill. Services in Hudson Bay area. Norseman and Anson.

AREA—Aerovias Ecuatorianas, C.A., Quito. Local services and to Panama and U.S.A. DC-3s and Boeing Stratoliners.

Arkia (Israel Inland Airlines, Ltd.), Tel Aviv. Domestic routes with D.H.89 and C-46.

ATSA — Aero Transportes, S.A., Mexico City. Local services with DC-3s.

Avensa (Aerovias Venezolanas, S.A.), Caracas. (Associate of P.A.W.A.). Domestic routes with Convair 340, DC-3 and DC-4.

Aviaco (Aviacion y Comercio, S.A.), Madrid. Domestic services and to Algiers, Canary Isles, Belgium and Holland. Bristol 170s and Languedoc.

Aviateca (Empresa Guatemalteca de Aviacion), Guatemala City. Domestic services with DC-3s.

Baca Airlines, Jefferson City. Local services. Cessnas, Stinson Reliants and Bonanzas.

Bahamas Airways, Ltd., Nassau. (Subsidiary of B.O.A.C.) Local services with Grumman Goose.

Bonanza Airlines, Las Vegas. Local services in Nevada, Arizona and California with DC-3s.

Braathens South-American and Far East Airtransport, A.S., Oslo. Services from Oslo to Stavanger and Trondheim with Herons.

British Colonial Airlines, Inc., Belize. Local services in British Honduras with Cessna 170s.

British Commonwealth Pacific Airlines, Ltd.—See Qantas Empire Airways.

British Guiana Airways, Ltd., Georgetown. Local services and to B.W.I. DC-3s and Grumman Goose.

British West Indian Airways, Ltd., Port of Spain. (Owned by B.O.A.C.) Routes in West Indies and to Miami. DC-3s and Vikings. Viscounts on order.

Butler Air Transport, Pty., Ltd., Sydney. Local services with DC-3s and Heron.

California Central Airlines, Burbank. Local services in California with Martin 2-0-2s and DC-3s.

Caribair (Caribbean Atlantic Airlines, Inc.), San Juan. Domestic services to Dominican Republic and Virgin Is. with DC-3s.

Caspar Air Charters and Agencies, Ltd., Nairobi. (In conjunction with E.A.A.C.) Local services with D.H.89.

CAT (Civil Air Transport), Taipeh. Domestic routes and to Manila, Hongkong, Bangkok, Okinawa, Japan and Korea. DC-3s, DC-4s and C-46s.

Cathay Pacific Airways, Ltd., Hongkong. Routes to Singapore, Bangkok, Calcutta, Rangoon and Indo-China. DC-3 and DC-4.

CAUSA (Compania Aeronautica Uruguaya, S.A.), Montevideo. Services linking Uruguay and Argentina with Sandringhams.

Central African Airways Corporation, Salisbury. Services in Central Africa and to South Africa and United Kingdom. Vikings and Beavers.

Central Airlines, Fort Worth, Texas. Local services with DC-3s.

Central Northern Airways, Ltd., Winnipeg. Local services. Fleet includes Beaver, Anson, Electra and Norseman.

C.G.T.A.—Air Algérie (Compagnie

Passengers from Amsterdam arriving at London Airport in the K.L.M. Convair CV-240 "Jan van Goyen." K.L.M.'s Convairs—both 240s and 340s are in service—all bear the names of Flemish artists.

"Flight" photograph

THE WORLD'S AIRLINES . . .

Générale de Transports Aériens—Air Algérie), Algiers. Services in North Africa and to Majorca, France and Switzerland with DC-3s and DC-4s.

CMA (Compañia Mexicana de Aviación, S.A.), Mexico City. (Affiliate of P.A.W.A.) Routes are domestic and to Cuba and U.S.A. DC-3s, DC-4s, DC-6s and DC-6Bs.

Commercial Air Services (Pty.), Ltd., Johannesburg. Local services with Lodestars.

Compania de Aviacion Faucett, S.A., Lima. Local services with DC-3, DC-4 and Stinson.

Compania Dominicana de Aviacion S.A., Ciudad Trujillo. Domestic routes and to Puerto Rico and U.S.A. DC-3s and C-46s.

Connellan Airways, Ltd., Alice Springs. Local routes with D.H.89.

COPA (Compania Panamena de Aviacion, S.A.), Panama City. (Associate of P.A.W.A.) Local services with DC-3s.

Cordova Airlines, Inc., Anchorage. Local services with mixed fleet.

Corps d'Aviation de l'Armee d'Haiti, Port au Prince. Local services with DC-3s and Beech 18s.

Cosara (Société des Transports Aériens de l'Extrême Orient), Saigon. Local services with DC-3s and Bretagne.

CSA (Ceskoslovenské Aerolinie), Prague. Domestic routes and to East European countries and Scandinavia. DC-3s and IL 12s.

Cyprus Airways, Ltd., Nicosia. (B.O.A.C. and B.E.A. Associate.) Route network in Near East and to North Africa. Fleet of DC-3s. Viscounts operated by B.E.A. in association to Athens and Beirut.

DETA (Divisão de Exploração des Transportes Aéreos), Lourenço Marques. Domestic routes and to S. Rhodesia and South Africa. DC-3s, Lodestars and Doves.

DHY (Devlet Hava Yollari—Turkish State Air Lines), Ankara. Domestic Services and to Lebanon, Cyprus and Greece. DC-3s. On order Herons.

D.T.A. (Divisão dos Transportes Aéreos), Luanda. Routes in W. Africa. DC-3s, Beech 18s and other types.

East African Airways Corporation, Nairobi. Serving Kenya, Tanganyika, Uganda, Zanzibar, Portuguese East Africa and South Africa. DC-3s and D.H.89s.

East-West Airlines, Ltd., Tamworth, N.S.W. Local services with DC-3s and Hudsons.

Ellis Air Lines, Ketchikan. Local services with Grumman Goose.

Ethiopian Air Lines, Inc., Addis Ababa. (In association with T.W.A.) Domestic services and to Kenya, Aden, Sudan and Egypt. Convair 240s and DC-3s.

Federation Air Service, Kuala Lumpur. (In association with Malayan Airways.) Local services with Beavers.

Fiji Airways, Suva. Local services with D.H.89s.

FINNAIR (Aero O/Y), Helsinki. Domestic services and to Sweden, Denmark, Germany and France. Convair 340s and DC-3s.

Flugfélag Islands, H.F., Reykjavik. Domestic services and to United Kingdom, Norway and Denmark. DC-3s, DC-4s and Canso.

Flying Tiger - Slick Airways, Burbank. U.S. Transcontinental freight services with DC-6As, DC-4s and C-46s.

Frontier Airlines, Inc., Denver. Local services in Colorado, Montana, Arizona, New Mexico, Utah and Wyoming with DC-3s.

Garuda Indonesian Airways, N.V., Djakarta. Services in Indonesia and to Bangkok, Singapore and Manila. DC-3s, Herons, Convair 240s and Canso.

Gibbes Sepik Airways, Ltd., Wewak. Local services in New Guinea with Norseman. Operations suspended at this time.

Gibraltar Airways, Ltd., Gibraltar. (In association with B.E.A.) Service Gibraltar-Tangier. DC-3s operated by B.E.A.

Grupo de Transportes, Lima. Domestic services in Peru with DC-3s and D.H.89s.

Guest Airways, Mexico City. Flying Mexico-Miami with DC-4s.

Guinea Airways, Ltd., Adelaide. Local services with DC-3s.

Gulf Aviation Co., Ltd., Bahrein. (Associate of B.O.A.C.) Operating Gulf services with Doves.

Hamiata (Sino-Soviet Aviation Corporation), Alma Ata. Operating Alma Ata to Hami with Li-2s.

Hawaiian Airlines, Ltd., Honolulu. Inter-island services with Convair 340s and DC-3s.

Helicopter Air Service, Inc., Chicago. Mail operations in Chicago area with Bell 47s.

Hong Kong Airways, Ltd., Hong Kong. (Owned by Jardine, Matheson & Co., Ltd.) Operating Hong Kong-Formosa-Okinawa-Tokyo services with DC-4.

Iranian Airways Company, Teheran. Domestic routes and to India, Pakistan and Kuwait. DC-3s.

Iraqi Airways, Baghdad. Domestic services and to Aleppo, Damascus and Cairo. Vikings and Doves. On order Viscounts.

Island Air Service, Port Clinton, Ohio. Local services with Ford Trimotors.

ITAU (Companhia Itaú de Transportes Aéreos), Rio de Janeiro. Domestic freight services with C-46s.

Japan Air Lines, Tokyo. Domestic and trans-Pacific services. DC-4s, DC-6Bs and Herons. On order Comet 2s.

Jugoslovenski Aero Transport, Belgrade. Domestic services and to Greece, Turkey, Austria, Germany and France. Convair 340s and DC-3s.

Karhumäki Airways, Halli. Finnish domestic services and to Sweden with DC-3s.

Korean National Airlines, Pusan. Domestic services with DC-3s and DC-4.

LACSA (Lineas Aereas Costarricenses, S.A.), Sandose. (Subsidiary of P.A.W.A.) Domestic services and to Panama, Mexico, Cuba and U.S.A. Convair 340s, DC-3s and C-46s.

LADE (Lineas Aereas del Estado), Buenos Aires. Domestic routes. DC-3s and Vikings.

Lake Central Airlines, Indianapolis. Local services with DC-3s.

LAN (Linea Aerea Nacional, Chile), Santiago. Domestic routes and to Argentina, Uruguay and Bolivia. Martin 2-O-2s, DC-3s, Doves and Electras.

La Nica (Lineas Aereas de Nicaragua, S.A.), Managua. (Associate of P.A.W.A.) Local services with DC-3s.

LAV (Linea Aeropostal Venezolana), Caracas. Domestic routes and to U.S.A., Cuba, Peru, Bermuda, Azores, Portugal, Spain and Italy. Lockheed Constellations, Martin 2-O-2s and DC-3s. On order Comet 2s.

Leavens Bros. Air Services, Ltd., Toronto. Operating Leamington to Pelee Is. Cessna Crane and Aeronca Sedan.

Liberian National Airways, Robertsfield. Local services with DC-3s and D.H.89s.

Linea Aerea Taca de Venezuela, Caracas. Domestic services and to Colombia with DC-3s.

Lloyd Aereo Boliviano (LAB), Cochabamba. Domestic services with DC-3s.

Loftleidir, H.F., Reykjavik. Operating transatlantic services in association with Braathens. Douglas DC-4s.

Loide Aereo Nacional, S.A., Rio de Janeiro. Domestic services with DC-3s and C-46s.

Los Angeles Airways, Inc., Los Angeles. Helicopter mail services in Los Angeles area with S-51s and S-55s.

LOT (Polskie Linie Lotnicze), Warsaw. Domestic routes and to Eastern Europe and Belgium, France, Denmark and Sweden. IL-12s and DC-3s.

Mackey Airlines, Inc., Fort Lauderdale. Local services and to Nassau with DC-3s.

MacRobertson-Miller Aviation Co., Pty., Ltd., Perth. Routes in Western Australia and to Northern Territory. DC-3s and Ansons.

Malayan Airways, Ltd., Singapore. (Associate of B.O.A.C.) Domestic services and to Bangkok, Saigon, Medan, Palembang and North Borneo with DC-3s. Also services in North Borneo with D.H.89s.

Malta Airlines, Valetta. Routes operated by B.E.A.

Mandated Airlines, Ltd., Lae. Routes in New Guinea with DC-3s, Dragons and Doves.

Maritime Central Airways, Charlottetown, Prince Edward Is. Operating in the Maritimes. DC-3s, Electras, Bristol 170, Beaver and other types.

Maszovlet (Magyar-Szovjet Polgari Legiforgalmi), Budapest. Domestic services and to neighbouring countries. Li-2s.

Midway Airlines, Chicago. Local air taxi service from Chicago Airport to city and suburbs. Cessna 195As.

Midwestern Aero Service, Carbondale, Ill. Local services with Cessna 195s.

Middle East Airlines Co., Beirut. (Associated with P.A.W.A.) Services in Near East. DC-3s.

Misrair S.A.E., Cairo. Domestic services and to Sudan, Aden, Saudi Arabia, Libya, Tunisia, Syria, Iraq, Lebanon, and Persian Gulf. Vikings and Languedocs. On order Viscounts.

Mohawk Airlines, Inc., Ithaca, N.Y. Local services with DC-3s.

Navegacao Aerea Brasileira (N.A.B.), Rio de Janeiro. Local services with DC-3s.

New York Airways, Inc., New York. Local passenger, mail and express services with S-55 helicopters.

North Central Airlines, Inc., Minneapolis. Local services with DC-3s.

Northern Consolidated Airlines, Inc., Anchorage. Local services with DC-3s and Cessna Cranes.

Northern Wings, Ltd., Seven Islands. Local services with Norseman, Anson, Canso and Beechcraft.

Orient Airways, Ltd., Karachi. Domestic services and to India and Burma. Convair 240s and DC-3s.

Ostermans Aero, A.B., Stockholm. Scheduled mail services in Stockholm archipelago in winter with Bell 47s.

Ozark Air Lines, Inc., St. Louis, Mo. Local services in Arkansas, Indiana, Iowa, Oklahoma, Kentucky, Kansas, Missouri, Illinois and Tennessee. DC-3s.

Pacific Northern Airlines, Seattle. Operating in Alaska and between U.S.A. and Alaska. DC-3s, DC-4s and smaller aircraft.

Pacific Western Airlines, Ltd., Vancouver. Services in British Columbia with mixed fleet.

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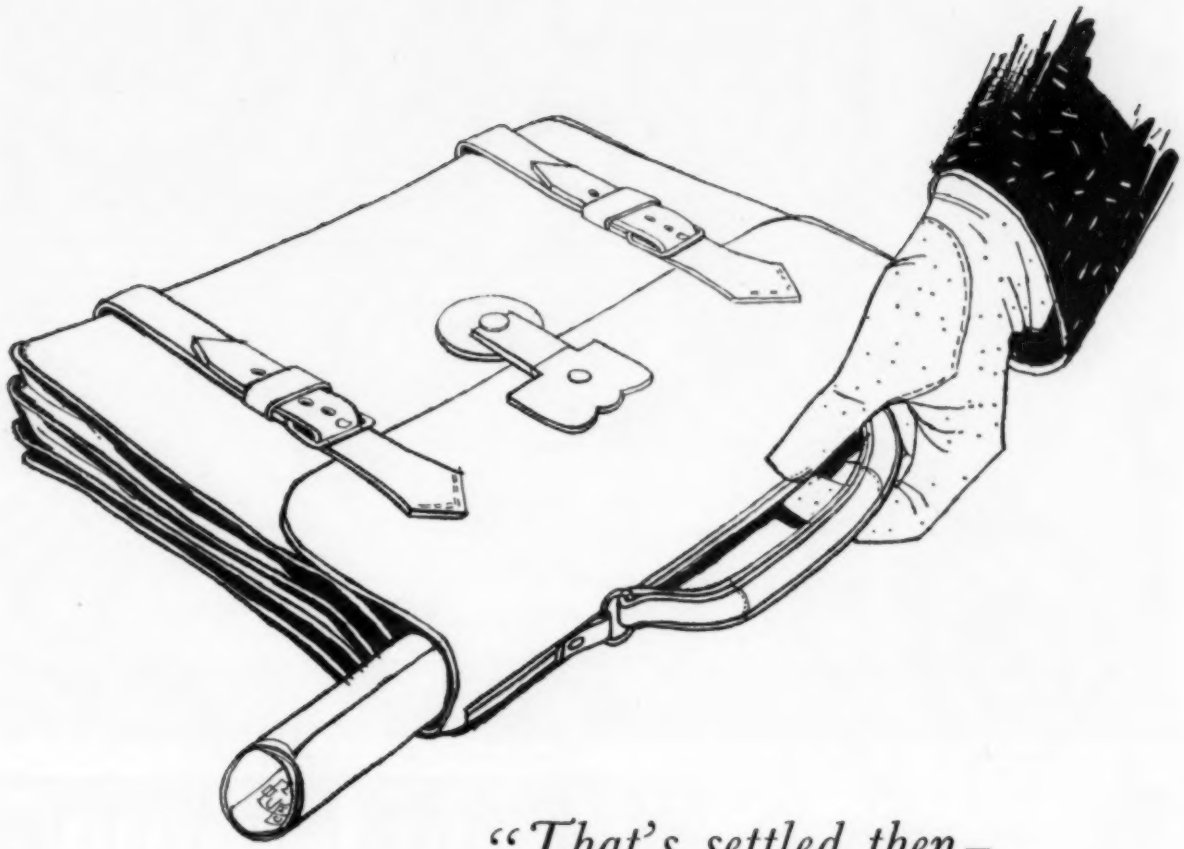
"Flight" photograph



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THE WORLD'S AIRLINES . .

Pakistan International Airlines, Karachi. To operate long-distance services with Super Constellations.

Panair do Brasil, Rio de Janeiro. Domestic network of 60,000 miles and transatlantic services. Constellations, DC-3s and Catalinas.

Philippine Air Lines, Inc., Manila. Domestic routes and to Hong Kong and Bangkok with DC-3s and Convair 340s.

Piedmont Airlines, Winston Salem, N. Carolina. Local services in N. and S. Carolina, Kentucky, Ohio, Tennessee, Virginia and West Virginia. DC-3s.

Pioneer Air Lines, Inc., Dallas. Local services in Texas and New Mexico with DC-3s.

PLUNA (Primeras Lineas Uruguayas de Navigacion Aerea), Montevideo. Domestic services with DC-3s and Herons.

Provincetown-Boston Airline, Provincetown, Mass. Local services in summer.

"Q" Airways (Aerovias "Q," S.A.), Havana. Operating to Isle of Pines and W. Palm Beach with DC-3s.

Quebecair, Inc., Rimouski. Local services with DC-3s and Beavers.

Queen Charlotte Airlines, Ltd., Vancouver. Services in British Columbia with DC-3s, Cansos, Stranraer and Norseman.

Queensland Airlines (Pty.), Ltd., Brisbane. Operating services in N.S.W. and Queensland with DC-3s.

REAL (Real, S.A., Transportes Aereos), Sao Paulo. Domestic services and to Paraguay and Uruguay with DC-3s.

Reeve Aleutian Airways, Inc., Anchorage. Operating routes to the Aleutians with DC-3s.

Régie Aérienne Interinsulaire, Papeete, Tahiti. Local services in Society Islands with Grumman Mallard.

S.A. Viaçao Aerea Gaucha (Savag), Rio Grande do Sul, Brazil. Domestic routes with DC-3s.

SATA (Sociedade Acoriana de Transportes Aéreos, Lda), Ponta Delgada. Local routes in Azores with Doves.

Saskatchewan Goverament Airways, Prince Albert. Local services. Canso, Norseman, Anson, Beaver and other types.

Saudi Arabian Airlines, Jeddah. Operates network of Near East routes with DC-3s, DC-4s and Bristol 170s.

Servicio Aereo de Honduras, S.A. (SAHSA), Tegucigalpa. (Associate of P.A.W.A.) Domestic services with DC-3s.

SKOGA (Airline of People's Democratic China), Pekin. Chinese domestic services and Pekin-Moscow in conjunction with Aeroflot. Li 2s.

SOKAO (Soviet-North Korean Airline), Feng-Yang. Operates part of Feng-Yang to Moscow route in collaboration with Aeroflot and Skoga. Believed to operate Il 12s.

Southern Airways, Inc., Atlanta. Local services in Southern States with DC-3s.

Southwest Airways Company, South San Francisco. Local services in California and to Oregon with Martin 2-O-2s and DC-3s.

Sudan Airways, Khartoum. Domestic routes with DC-3s and Doves.

Syrian Airways Company, Damascus. Domestic services and to Saudi Arabia and Kuwait with DC-3s.

TABSO (Bulgarski Vzduszni Linii), Sofia. Domestic routes and to Hungary and Czechoslovakia with LI 2s.

T.A.C. (Empresa de Transportes Aéreos Catarinence, S.A.), Florianopolis. Brazilian domestic services with DC-3.

Taca de Costa Rica, S.A., San Jose. Domestic services with DC-3s.

Taca de Honduras, Tegucigalpa. Domestic services with DC-3s.

Taca International Airlines, S.A. New Orleans, Louisiana. Serving Costa Rica, El Salvador, Guatemala, Honduras, British Honduras, Mexico and Nicaragua with DC-3s and DC-4s.

TAE (National Greek Airlines), Athens. Domestic services and to United Kingdom, France, Italy, Turkey, Yugoslavia and Egypt with DC-3s and DC-4s.

TAP (Transportes Aéreos Portugueses), Lisbon. Domestic Services and to Spain, United Kingdom, West Africa, Morocco and France with DC-3s and DC-4s.

TARS (Societate Româno-Sovietică de Transporturi Aeriene), Bucharest. Domestic services with Li 2s.

Thai Airways Co., Ltd., Bangkok. Domestic services and to India, Burma, Hong Kong, Formosa, Japan, Indo-China and Malaya with DC-4s, DC-3s, Bonanzas and Norseman.

TPA Aloha Airline, Honolulu. Operates inter-island routes with DC-3s.

Trans Mar de Cortes, Guaymas. Services in Mexico with DC-3s.

Transportes Aereos de Jalisco, S.A., Guadalajara. Services in Mexico with DC-3s.

Transports Aériens du Gabon, Gabon, F.E.A. Local services with D.F..89s.

Transportes Aereos Nacional Ltda., Rio de Janeiro. Domestic services with DC-3s.

Transportes Aereos Nacionales, S.A., Tegucigalpa. Services from Honduras to U.S.A., Cuba, Nicaragua and El Salvador.

Transportes Aereos Salvador, Salvador. Local Brazilian services with Herons.

Transair Sweden, A.B., Stockholm. Stockholm-Visby route and newspaper flights with DC-3s and Consuls.

Trans-Texas Airways, Houston. Local services in Texas with DC-3s.

Trust Territory Operations, Guam. (Operated by Transocean Airlines.) Services to Caroline Is., Palau Is. and Marshall Is. with Cansos.

Tunis Air (Société Tunisienne de l'Air). Tunis. Services in North Africa and to France with DC-3s and Languedoc.

Union of Burma Airways (UBA), Rangoon. Domestic services and to Thailand, Malaya and India with DC-3s, Doves and Marathons.

Uraba, Medellin and Central Airways, Inc. (UMCA), Medellin. Domestic services with Convair 240.

VARIG (S.A. Empresa de Viação Aérea Rio Grandense), Porto Alegre. Domestic services in Brazil and to Uruguay and Argentina with DC-3s and C-46s.

VASP (Viação Aérea Sao Paulo, S.A.), Sao Paulo. Domestic services in Brazil with DC-3s and Scandias.

Vestlandske Luftfartselskap A.S. (West-Norway Airlines), Bergen. Operates West-Norway services with Sealands.

West African Airways Corporation, Lagos. Domestic services and to neighbouring countries with Bristol 170s and Doves.

West Coast Airlines, Seattle. Local services with DC-3s.

Wheeler Airlines, Ltd., St. Jovite. Local services in Quebec Province with Ansons.

Wideroe's Flyveselskap og Polarfly A.S., Oslo. Operating Northern Norway routes, some on behalf of S.A.S., with Otter and Norseman.

Wien Alaska Airlines Inc., Fairbanks. Domestic services with mixed fleet.

Woods Airways Pty, Ltd., Perth, Western Australia. Route from Perth to Rottnest Is. with Ansons.

BRITAIN'S INDEPENDENT OPERATORS

Air Charter, Ltd.—Charter (passengers and freight), trooping and pleasure flights. Head office, 15 Great Cumberland Place, London, W.1. Main base, Southend. Executives: Capt. E. N. Jennings (chief pilot and operations manager); G. W. Forster (commercial manager); A. F. Nickalls (chief accountant). Fleet: seven York C.1s, one Tudor II, two Tudor 1s, one Tudor III, one Tudor IVB, one DC-3 and two Bristol 170s Mk 31. On order, one Bristol 170. In 1953 Air Charter carried 12,515 passengers and 27,771 short tons of freight: revenue ton-miles flown, 4,615,154.

Air Couriers (Transport) Ltd.—Operators of charter services. Head office, Croydon Airport, Surrey. Main base, Croydon. Executives: G. G. Glanville, C. P. L. Godsal, F. W. Griffith (directors) and K. J. Kelly (chief engineer). Fleet: two Rapides and one Gemini.

Air Kruise, Ltd., (Trans-Channel Airways).—Scheduled passenger and charter services. Head office, Lympne Airport, Near Hythe, Kent. Main bases, Lympne and Ramsgate. Executives: W/C. H. C. Kennard (managing director), A. W. Ross (director and secretary), and C. Bossom (director). Scheduled routes: Lympne-Le Touquet, Lympne-Ostend, Lympne-Zurich, Lympne-Basle, Lympne/Ramsgate-Birmingham, Ramsgate-Le Touquet. Fleet: four Rapides and two Dakotas. In 1953 Air Kruise carried 22,500 passengers.

Air Navigation and Trading Co., Ltd.—Contract charter services and flying training. Head office, Squires Gate Airport,

Hunting-Clan Air Transport recently undertook a large-scale charter to Malta; three of the aircraft engaged are seen here in their new livery.

BRITAIN'S INDEPENDENT OPERATORS . . .

Blackpool. Main bases, Blackpool and Middleton. Executives: R. L. Whyham (chairman and chief engineer), G. C. S. Whyham (operations manager), and C. S. J. Ashley (chief pilot). Fleet: two Avro 19s, four Ansons, two Rapides, two Dragons, six Austers, four Tiger Moths and three Proctors. On order: one Drover or Otter.

Airviews, Ltd.—Scheduled passenger services, charter and pleasure flights and aerial photography. Main office, Ringway Airport, Manchester. Main base, Ringway. Executives: J. B. Martin and H. A. McCarthy. Scheduled routes: Manchester-Southampton-Isle of Wight (not yet in operation). Fleet: Rapide, Auster, Cygnet and Tiger Moth.

Airways Union, Ltd.—The company controls subsidiaries engaged in the operation of airports, flying clubs, air charter services and flying schools. Head office, The Airport, Weston-super-Mare, Somerset. Main bases, Weston-super-Mare, Exeter and Plymouth. Executives: R. King-Farlow (chairman), S. J. Cox (secretary and general manager), F. G. Jeans, W. R. Parkhouse and R. J. B. Pearse. Fleet: two Geminis, three Austers, three Tiger Moths, one Miles Messenger and one Proctor. In 1953 Airways Union carried 3,858 passengers.

Airwork, Ltd.—Operators of scheduled passenger and freight services, long-term contract flying and trooping services. Head office, 15, Chesterfield Street, London, W.1. Main bases, Blackbushe and London Airport. Executives: M. D. N. Wyatt (chairman), Sir Archibald Hope (managing director) and R. Loudon Cumming (director and secretary); air transport division—A. G. Miller (manager), K. R. Sangster (commercial manager), W. K. Davison (operations manager); commercial department—Col. B. A. Wilson and L. Castlemaine. Scheduled routes: Colonial coach services from London to Nairobi, Salisbury and Lagos with intermediate traffic on each route. Additional scheduled services approved by M.T.C.A. for future operation: passenger services London-Aden; freight services from London to Montreal, New York, Aden, Hamburg, Frankfurt, Zürich, Dukhan (and points *en route*), Marseilles-Rome and Basle-Milan-Rome. Existing fleet, three Hermes, 11 Vikings and three Dakotas. No information available on new aircraft or 1953 traffic.

Aquila Airways, Ltd.—Scheduled flying-boat passenger services, and charter and trooping work. Head office, 1, Great Cumberland Place, London, W.1. Main base, Southampton. Executives: B. T. Aikman (managing director) and R. Clark (operations manager). Scheduled routes: Southampton-Lisbon-Madeira-Canary Islands and Southampton-Marseilles-Capri. Fleet: two Short Solents and three Short Hythes. In 1953 Aquila Airways carried about 6,000 passengers.

B.K.S. Air Transport, Ltd.—Scheduled passenger and freight services, charter and trooping work and a daily newspaper-service to Germany. Head office, Dorset House, Old Burlington Street, London, W.1. Main bases, Newcastle, Southend and West Hartlepool. Executives: J. W. Barnby, T. D. Keegan and C. J. Stevens. Scheduled routes: Newcastle and/or West Hartlepool to Jersey, Isle of Man and Isle of Wight; Inclusive tours: Southend - Corsica - Southend, Southend - Majorca - Southend, Southend-Corsica-Majorca-Southend, Newcastle-Lourdes-Newcastle and Newcastle-Paris-Newcastle. Additional routes approved by M.T.C.A. for future operation: Inclusive tour, Newcastle-Basle-Newcastle. Fleet: five Dakotas. In 1953 B.K.S. Air Transport carried 7,717 passengers and flew 317,384 revenue ton-miles.

Cambrian Air Services, Ltd.—Scheduled passenger services, charter and army co-operation flights. Head office, Rhoose Airport, near Barry, Glamorgan. Main base, Cardiff (Rhoose). Executives: J. H. Watts (chairman), W/C. L. B. Elwin and W. W. Stanley (joint managing directors), B. J. T. Callan (commercial and operations manager), A. W. Townsend (chief pilot) and L. E. Moore (chief engineer). Scheduled routes: Liverpool to Cardiff-Bristol-Jersey-Guernsey; Cardiff to Paris-Jersey-Guernsey-Haverfordwest-Liverpool-Southampton; Bristol to Paris-Jersey - Guernsey - Liverpool - Southampton; Cheltenham/Gloucester to Paris-Jersey-Guernsey; Southampton to Paris-Bristol-Cardiff. Additional routes approved by the M.T.C.A. for future operation: Haverfordwest-Swansea-Cardiff-London and Haverfordwest-Dublin (provisional approval). Fleet: one Dakota, three Doves, four Rapides, one Proctor and one Auster. In 1953 Cambrian Air Services carried 19,476 passengers and flew 455,000 revenue ton-miles.

Channel Airways (East Anglian Flying Services, Ltd).—Scheduled passenger and charter services. Head office, Southend Airport, Southend. Main bases, Southend and Shoreham. Executives: S/L. R. J. Jones (managing director), A. E. Hugo Parsons (director-operations) and D. G. Burgess (chief pilot). Scheduled routes: Ipswich-Southend-Rochester-Shoreham-Paris; Ipswich - Southend - Rochester - Shoreham - Channel Islands; Ipswich-Southend-Ostend and Ipswich-Southend-Calais (as from June 1st). Fleet: four Rapides, two Proctors, two Tiger Moths and one Auster. In 1953 Channel Airways carried 2,000 passengers.

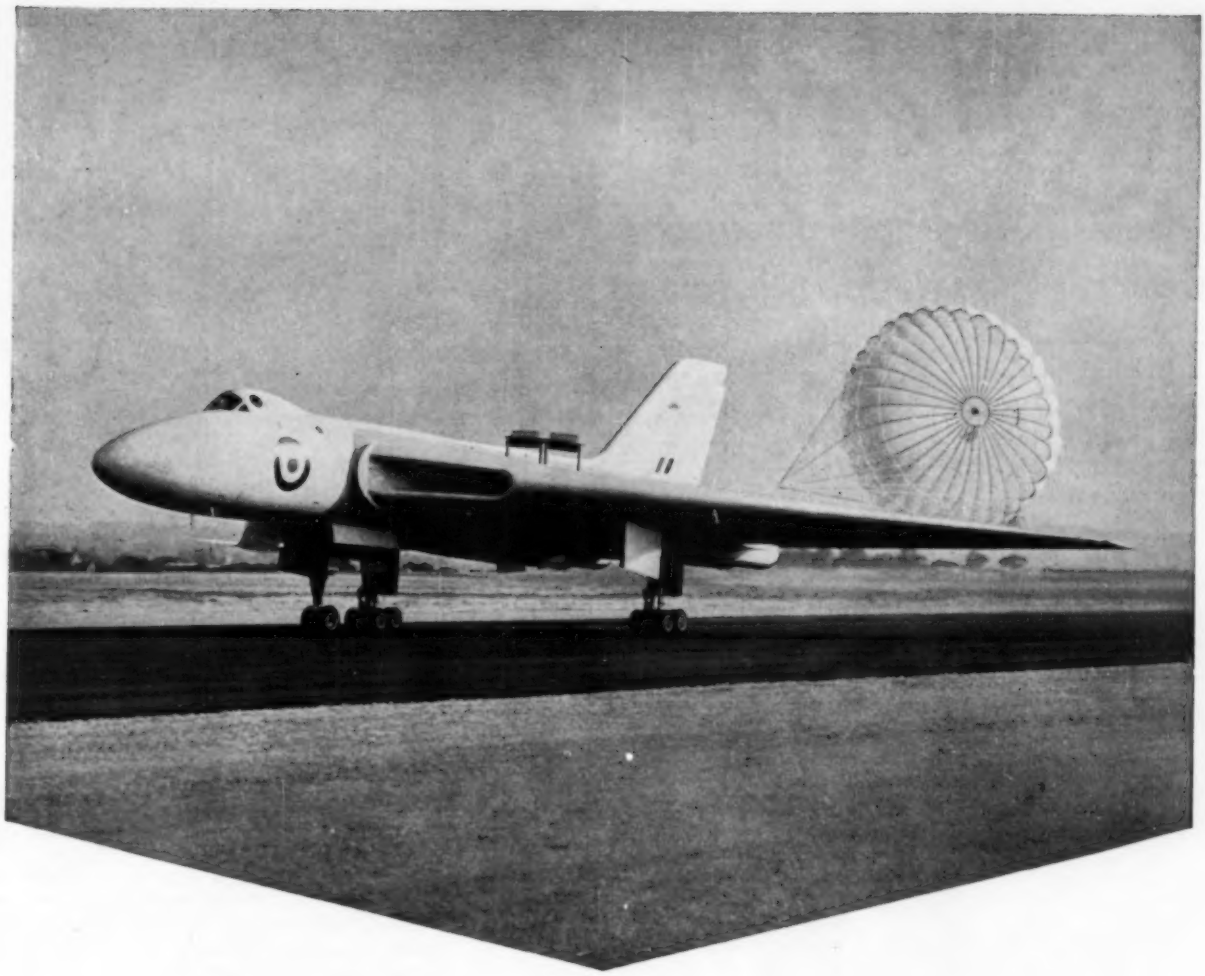
Dan-Air Services, Ltd.—Operators of charter services. Head office, Bilbao House, 36 New Broad Street, London, E.C.2. Main base, Southend. Executives: F. E. F. Newman, J. W. Davies and E. O. Wallis (directors), and Capt. F. R. Garside (chief pilot and operations manager). Scheduled route: Southend-Calvi (Corsica). Fleet: two Dakotas. In 1953 Dan-Air Services carried 4,243 passengers and flew 108,921 revenue ton-miles (part year only).

Derby Aviation, Ltd.—Operators of scheduled passenger services, charter, pleasure and army co-operation. Head office, 78 Buckingham Gate, London, S.W.1. Main bases, Derby and Wolverhampton. Executives: G/C. C. A. B. Wilcock (chairman), J. Harben-Grice (deputy chairman), W/C. H. A. Roxburgh (managing director), E. W. Phillips, L. E. T. Barley, R. R. Paine, A. C. Felts (company secretary), K. W. Felts (chief engineer), and E. W. A. Lines (chief pilot). Scheduled routes: Derby-Wolverhampton-Elmdon-Jersey. Additional routes approved by M.T.C.A. for future operation: as above, but extended to Tollerton. Fleet: three Rapides, two Geminis and one Avro 19. In 1953 Derby Aviation carried 634 passengers.

Don Everall (Aviation), Ltd.—Operators of scheduled services, charter and aerial photography, advertising and ambulance services. Head office, Elmdon Airport, Birmingham. Main base, Elmdon. Executives: D. Everall and C. Everall (directors), A. D. Atkinson (operations manager) and E. Holden (chief engineer). Scheduled routes: Birmingham-Leicester East-Jersey-Guernsey; Coventry-Wolverhampton-Isle of Man and Birmingham-Weston-super-Mare-Cardiff. Fleet: three Rapides, one Messenger and one Auster. In 1953 Don Everall carried 3,356 passengers.

Eagle Aviation, Ltd.—Scheduled passenger services and charter and trooping flights. Head office, 29, Clarges Street, London, W.1. Main base, Blackbushe. Executives: Harold Bamberg (managing director), N. Ashton Hill, P. C. F. Morgan and

Troopers : Two of Skyways' fleet of Avro Yorks—civil aircraft, despite the roundels—in company with five of the company's passenger coaches.



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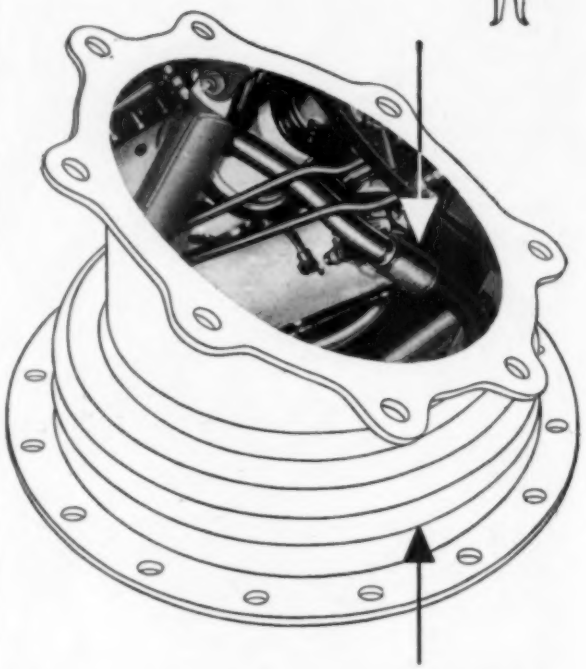

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BRITAIN'S INDEPENDENT OPERATORS . . .

Major General Greaves (directors), G. W. Pitt (charter division sales manager) and Eric Hanks (airline division sales manager). Scheduled routes: London-Aalborg-Gothenburg and London-Belgrade. Fleet: seven Vikings and four Dakotas. In 1953 Eagle Aviation carried 15,624 passengers and 270 tons of freight: revenue ton-miles flown, 10,031,124.

Flightways, Ltd.—Charter passenger and freight and army co-operation. Head office, Southampton Airport, Southampton. Main base, Southampton. Executives: V. H. Bellamy and L. Bellamy (directors) and T. L. Cook (chief pilot). Fleet: two Rapides and one Proctor.

Herts and Essex Aero Club (1946), Ltd.—Operators of charter passenger services. Head office, Broxbourne Aerodrome, Nazeing, Essex. Main base, Broxbourne. Executives: A. R. Grogley (managing director) and P. Ayles (operations manager). Fleet: four Tiger Moths, one Hornet Moth, one Proctor, one Rapide, four Austers, two Geminis and one Messenger.

Hunting-Clan Air Transport, Ltd.—Scheduled passenger services, charter, trooping and pleasure flights. Head office, 5, Fitzhardinge Street, Portman Square, London, W.1. Main base, Bovingdon and Woolsington. Executives: M. H. Curtis (managing director), E. H. Baker (secretary), Col. B. J. O. Burrows (assistant to managing director), Capt. B. B. Greensted (technical manager), H. G. Matheson (scheduled services manager), R. Wingrave (charter manager), A. J. Stocks (traffic superintendent) and Capt. R. Mulliner (chief pilot). Scheduled routes: Newcastle to London, Manchester, Glasgow, Paris, Amsterdam and Dusseldorf, Hamburg and Copenhagen, and Oslo and Stockholm; London to N'dola, Lusaka and Salisbury, Entebbe and Nairobi, and Bathurst, Lagos and Accra. Additional route approved by the M.T.C.A. for future operations: Newcastle-Belfast. Fleet: eight Vikings, five Dakotas and two Yorks. On order: three Viscounts. In 1953 Hunting-Clan Air Transport carried 72,295 passengers and flew 2,913,678 revenue ton-miles.

Island Air Services (London), Ltd.—Operators of general charter and passenger services and pleasure flights at Northolt and London Airports. Head office, London Airport, Hounslow, Middlesex. Main base, London. Executives: Monique Rendall (managing director and chief pilot), R. C. Rendall (director) and Jean Edwards (operations manager). Fleet: three Rapides.

Jersey Airlines (Airlines [Jersey], Ltd.).—Scheduled passenger services and charter flights. Head office, 4, The Parade, St. Helier, Jersey, Channel Islands. Main base, Jersey. Executives: M. L. Thomas (managing director) and W/C. L. A. Egglesfield (general manager). Scheduled routes: Manchester, Coventry and Bournemouth to Channel Islands, Dinard and La Baule, London-Channel Islands-St. Brieuc-Lannion-Brest, Exeter-Channel Islands, Caen and Paris and inter-channel islands services. Application pending for Jersey-Bilbao (Spain). Fleet: two Herons and eight Rapides. On order: one Heron. In 1953 Jersey Airlines carried 42,571 passengers and 7.41 short tons of freight; revenue short ton-miles flown, 143,201.

Marshall Flying Services, Ltd.—Charter and pleasure flights. Head office, The Aerodrome, Newmarket Road, Cambridge. Main base, Cambridge. Executives: A. G. G. Marshall (managing director) and H. E. Tappin (manager/chief pilot). Fleet: three Rapides. In 1953 Marshall Flying Services carried 1,800 passengers.

Manx Airlines, Ltd.—Scheduled services for passengers and freight; ambulance and charter flights. Head office, Ronaldsway Airport, Ballasalla, Isle of Man. Main base, Ronaldsway. Executives: G. H. Drummond (chairman), G. S. Hankinson (managing director) and T. L. Vondy (director). Scheduled routes: Isle of Man to Renfrew, Carlisle and Newcastle. Fleet: two Dakotas and four Rapides.

Morton Air Services, Ltd.—Operators of scheduled passenger services, charter and pleasure flights. Head office, Croydon Airport, Surrey. Main base, Croydon. Executives: T. W. Morton (managing director), J. J. Fargher (secretary), P. Eskell (commercial manager) and J. Warburton (chief pilot). Scheduled routes: Croydon to Jersey, Guernsey and Le Touquet. Fleet: four Doves, three Consuls and one Rapide. In 1953 Morton Air Services carried 12,288 passengers.

Olley Air Service, Ltd.—Scheduled passenger services, charter and pleasure flights. Head office, Croydon Airport, Surrey. Main base, Croydon. Executives: T. W. Morton (chairman), S. A. Carter (secretary and commercial manager) and J. Warburton (chief pilot). Scheduled routes: Croydon to Jersey/Guernsey, and to race meetings. Fleet: three Doves, two Consuls and two Rapides. In 1953 Olley Air Service carried 11,900 passengers.

Scottish Airlines.—Scheduled services and charter trooping. Head office, Prestwick Airport, Ayrshire. Main bases, Prestwick and Stansted. Executives: J. A. Dobson (general manager), D. McConnell (commercial manager), I. C. Grant (chief pilot) and W. A. Wilkinson (technical superintendent). Scheduled routes: Prestwick-Ronaldsway. Fleet: three Yorks and two Dakotas. On order: six Prestwick Twin Pioneers. In 1953 Scottish Airlines carried 30,739 passengers and 195 tons of freight: revenue short ton-miles flown, 3,971,209.

Silver City Airways, Ltd.—Operators of scheduled vehicle ferries, passenger services, charter and trooping flights and livestock transportation. Head office, 1, Great Cumberland Place, London, W.1. Main bases, Lympne, Ferryfield, Blackbushe and Southampton. Executives: A/Cdre. G. S. Powell (managing director), W. G. Franklin (commercial general manager) and S. A. Tennant (technical general manager). Scheduled routes: Lympne to Ostend and Calais; Ferryfield-Le Touquet, Gatwick-Le Touquet and Southampton to Cherbourg and Isle of Wight. Fleet: nine Bristol Superfreighters; seven Bristol Freighters; two DC-3s; Rapides, etc. Option on more Superfreighters. In 1953 Silver City carried 96,625 passengers and 37,894 tons of freight; revenue ton-miles flown, 4,268,286.

Skyways, Ltd., and Lancashire Aircraft Corporation.—Operators of scheduled passenger services, charter, trooping and pleasure flights. Head office, 7, Berkeley Street, London, W.1. Main base, Stansted. Executives: Eric Rylands (managing director), Charles F. Dickson (director), A/Cdre. Sydney Smith (contracts manager), A. J. Henderson (secretary), M. D. Day (technical manager), H. P. Snelling (commercial manager) and Mrs. E. Whittaker (head of public relations and assistant to managing director). Scheduled routes: Crusader service—United Kingdom-Cyprus and Malta-Cyprus. Fleet: 23 Yorks (operated by Skyways), four Dakotas and 12 twin- and single-engined aircraft (operated by Lancashire Aircraft Corporation). On order: ten Hermes. In 1953 Skyways and Lancashire Aircraft Corporation carried 103,385 passengers and 9,956 short tons of freight: revenue short ton-miles flown, 4,777,079.

Starways, Ltd.—Scheduled passenger services and charter flights. Head office, Liverpool Airport, Liverpool, 19. Main base, Liverpool (Speke). Executives: F. H. Wilson (chairman) and J. A. Wilson (director). Scheduled routes: Liverpool and Glasgow to Tarbes (Lourdes) and Liverpool-Biarritz. Fleet: five Dakotas. In 1953 Starways carried 6,030 passengers and 274 tons of freight: revenue ton-miles flown, 428,080.

Transair, Ltd.—Scheduled passenger services, mail, freight and charter services. Head office, Croydon Airport, Surrey. Main bases, Croydon and Gatwick. Executives: G. H. Freeman (chairman and managing director), C. Nunn (supplies controller), H. S. Perren (commercial manager), C. W. H. Bebb (operations manager), P. H. Meadway (chief pilot), D. L. Brooks (chief engineer), and W. A. Richardson (chief inspector). Scheduled routes: Croydon-Paris (freight and mail), Croydon-Jersey-Guernsey (freight and mail), Croydon-Jersey (passenger service), Gatwick to Lourdes, Graz, Nice and Alghero (inclusive tours). Fleet: eight Dakotas. In 1953 Transair flew 1,543,000 revenue miles.

Wolverhampton Aviation, Ltd.—Scheduled passenger services, charter, pleasure and army co-operation. Head office, 78, Buckingham Gate, London, S.W.1. Main bases, Wolverhampton and Derby. Executives: G/C. C. A. B. Wilcock (chairman), J. Harben Grice (deputy chairman), L. E. T. Barley (managing director), R. R. Paine, E. W. Phillips, W/C. H. A. Roxburgh, A. C. Felts (secretary), R. C. R. Cooper (chief engineer). Scheduled routes: Derby-Wolverhampton-Elmdon-Jersey (in association with Derby Aviation, Ltd.). Fleet: three Rapides, two Geminis and an Avro 19. In 1953 Wolverhampton Aviation carried 573 passengers.

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

"What an Australian Wants"

THE article by Mr. Stanley Brogden in your issue of April 16th, under the above title, gives a rather erroneous picture of the R.A.A.F. transport requirements. As another Australian, I believe Australia does not want Chase or Fairchild aircraft, nor an expenditure of dollars which is clearly unnecessary. Whilst Mr. Brogden may be expressing some R.A.A.F. views or atmosphere, it is wrong to state that the Blackburn Beverley is "too big" for the R.A.A.F. Incidentally, this impression would appear to be far too prevalent in U.K. also; it may, of course, come from opposition interests or from unthinking people.

It should be noted that the R.A.A.F. must, in addition to looking after its own war-time transport requirements, *cater for our Army* and, in peace-time, provide or be Australia's insurance against all calamities or national disasters, such as drought, bush-fire or flood.

Australia requires the best possible transport for war-time and peace-time use, and the Beverley is particularly suited for Australian operations, as well as being the most economical aircraft to operate. It is an aircraft the performance of which has not been "stretched" and, fitted with later type engines now being developed, its lifting capacity and economy are expected to be much better than they are today.

The Beverley is one item of defence equipment which the R.A.A.F. could hand over to our major airlines for peace-time operations, and especially for the development of the north of Australia, which area is vital to our defence. Further, operation of Beverleys by commercial airlines would ensure the establishment of equipment, overhaul facilities and trained personnel in areas which would be invaluable to our Air Force, such establishments being achieved, moreover, at no cost to the R.A.A.F.

Sydney. F. A. GANNON.

No. 8 Squadron and Aden

IN your account (under "Service Aviation," April 23rd) of the presentation of the Squadron Standard to No. 8 Squadron you say that in April 1928 the unit moved to Aden and that this year is the 25th anniversary of its arrival there. These dates cannot both be right and I am afraid that, in fact, neither is. I was adjutant of No. 8 Squadron when we moved to Aden from Iraq in 1927 and it has, therefore, completed 27 years there. The squadron at the time was commanded by S/L. W. A. McClaughry, who was killed during the last war as an air vice-marshal in the Middle East, and we were met and seen into the billets of the old Aden Flight by the then A.O.C. Middle East, A.V-M. Sir T. I. Webb-Bowen.

I don't think any of us who were there will forget the year we moved in because we had one of Aden's rare floods in April 1927 and had to get about the camp on rafts. We started by swimming from our huts, until we found that the water was coming through the camel lines.

Brentford, Middlesex. M. H. JENKS, W/Cdr. R.A.F.(Ret.).

[The dates given were by the Air Ministry—Ed.]

Vintage R-R. Engines: News Wanted

AS you may be aware, I am the owner of a sprint racing car, the Spitfire Special, fitted with a Rolls-Royce Merlin 25 aero engine. This superb engine having whetted my appetite, I have just managed to find a R-R. Kestrel 2S engine complete but somewhat weathered, having lain in a scrap yard for some 15 years after removal from a Hawker Nimrod, K.1623. I intend to restore this engine, as a show-piece for the time being, with the ultimate object of perhaps installing it in a suitable racing car chassis at a later date.

I am wondering if any of your readers might know of the whereabouts of any spares for this interesting vintage engine? I am particularly in need of a pair of valve rocker boxes, hand-starting magneto, and top water-pipe casting, which were damaged by a Vauxhall car having been dumped on top of the engine for many years!

To complete this collection of period R-R. aero engines, does anyone know of a veteran Eagle or Condor, perhaps lying in a scrap yard in similar circumstances to my unfortunate Kestrel?

Worthing, Sussex. F. M. WILCOCK.

The "five-up 536" referred to by Mr. Nepean Bishop.

Reminiscing

WITH reference to Mr. J. P. Herriot's letter under the above heading (*Flight*, May 7th) I imagine that the 504K with five seats he mentions was actually the type 536 which was used at Southsea, Hounslow and elsewhere for joy-riding in 1919.

I enclose two photographs of Southsea's particular "536," K137, the smaller one taken on the occasion of the Eastney Fair at the Royal Marine Barracks in August 1919. The second one [reproduced here—Ed.] was taken earlier in the summer on Southsea Common (which hallowed spot is now the site of the municipal bowling greens!) and shows four passengers *in situ*. The pilot was F/L. E. A. Sullock, A.F.C.

Croydon Airport. C. NEPEAN BISHOP.

YOUR correspondent Mr. J. P. Herriot asks if any of your readers can remember an Avro 504K with five seats having a C. of A. for joy-riding purposes. I flew in such an Avro from Croydon in company with three relatives on March 13th, 1926. This machine, G-EAKM, belonged to Surrey Flying Services and was piloted by Lt.-Col. Henderson. There were wooden bench seats across the fuselage. No doubt it had a C. of A.

May I also refer back to the correspondence concerning the S.E.5A? I do not think anyone mentioned the only Oxford and Cambridge air race ever to have taken place. It was flown at Hendon in July 1921 with S.E.5As. I knew some of the pilots and was present, but I am ashamed to say that I cannot remember who won.

Esher, Surrey. D. B. PARKINSON.

[The Cambridge team (R. K. Muir, H. A. Francis and W. S. Philcox) were the winners; fastest lap of the 129-mile course was 118.55 m.p.h.—Ed.]

Private-flying Maintenance Costs

THE letter from "Pedantica" [April 23rd] finishes by posing the old question, "Why is private flying so restricted?" without an answer.

When the R.A.F.V.R. was re-equipped a short time ago a large number of Tiger Moths came on the market at a relatively low cost. There was, however, no boom in private flying as a direct result. I suggest that this was because the first cost of an aircraft is no problem compared with the cost of spares and the services of licensed engineers essential for the operation of any aircraft.

It would appear that only engineers holding licences for both engine and airframe could possibly run an aircraft as one would run a car.

Hatfield, Herts. D. HOUSTON.

FORTHCOMING EVENTS

May	21.	Institute of Navigation: "Visual Aids to Bad-weather Approach," by Dr. E. S. Calvert.
May	22.	Leicestershire Aero Club: Air display.
May	25.	Society of Instrument Technology: Annual general meeting.
May	29.	R.A.F.A. Cheltenham and Gloucester: Air Display, Staverton.
May	29.	Percival Aircraft, Ltd., and Field Aircraft Services, Ltd.: "At Home" to owners of Percival aircraft, Luton.
May	29.	Ragosine/Auster Homing Cup Competition, Rearsby, Leicester.
May	29-30.	Leghorn Aero Club: Air Tour of Tuscany.
June	2.	Pescara Aero Club: International aerobatic contest.
June	5.	Swansea and District Flying School and Club: Welsh Air Derby.
June	5-6.	Niedersachen Section of Aero Club of Germany: International air rally, Hanover.
June	5-7.	French Aero Club: Rally.
June	6.	Modena Aero Club: International aerobatic contest, Modena.
June	7.	S.S.A.F.A.: Air display, Yeadon Aerodrome.
June	9-19.	Mechanical Handling Exhibition and Convention, Olympia.
June	11-13.	Royal Netherlands Aero Club: International air rally.
June	11-14.	Palermo Aero Club: Sixth International air tour of Sicily.
June	12.	Elstree Flying Club: "At Home" and flying display.
June	13.	Tangier Aero Club: Rally.
June	13.	R.Ae.S. Garden Party, London Airport.
June	18-19.	R.Ae.C.: National Air Races, Coventry Civic Aerodrome.
June	20.	Northamptonshire Aero Club: "At Home."
June	21-24.	Institute of the Aeronautical Sciences: Annual summer meeting, Los Angeles.
June	26.	Plymouth Air Display Committee: Air display.

A page from
THE ESSO HISTOIRE
OF
AERIAL LOCOMOTION
Adapted from the French de P. Crochet-Damais. Illustrated par Philippe Féty avec permission.

KING BLADUD AND THE OWLS

A long time ago, in Trinovantes (the site, it is said, is that of the present City of London), there lived an old, bearded and formidable king called Bladud. Now Bladud was something of a scientist and crazy about air travel. He had visited Athens—on foot, of course—and had studied the mysteries of ancient Egypt. In his palace he worked indefatigably to discover the principles of aeronautics. He invented the paper dart. He examined the mechanics of ornithological flight . . . .

And at last he fashioned for himself a flying-machine. It was made for the most part of feathers plucked from the wings of the royal owls. In the twentieth year of his reign Bladud launched himself from the roof of his workshop and achieved a quite fantastic airspeed in a downward direction. It would be an understatement to say that he touched down.

By a strange coincidence the twentieth year of his reign was also Bladud's last.

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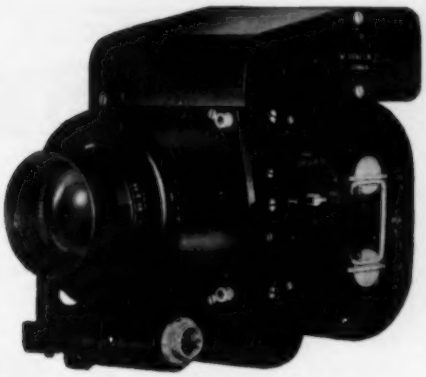

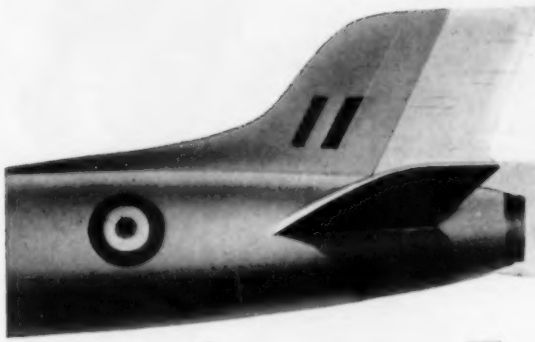

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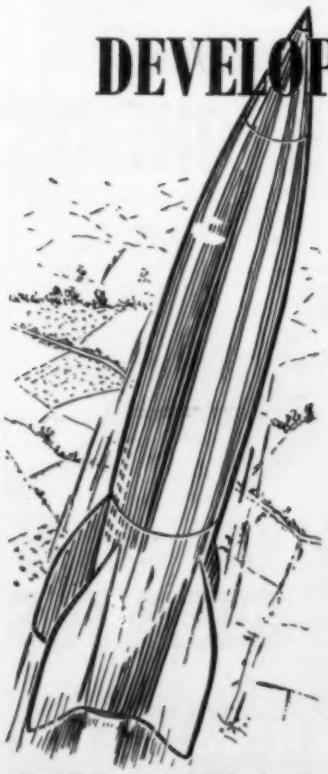

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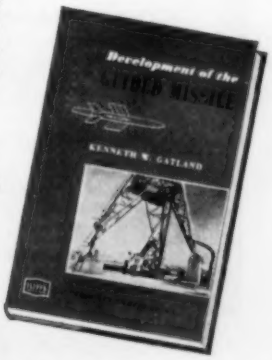

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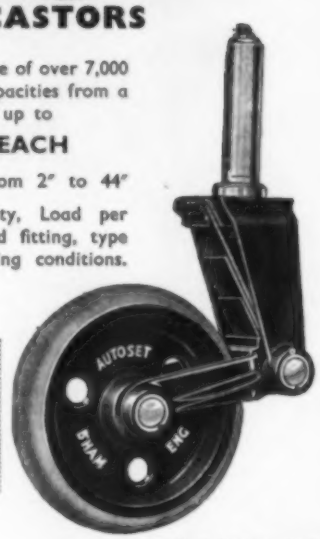

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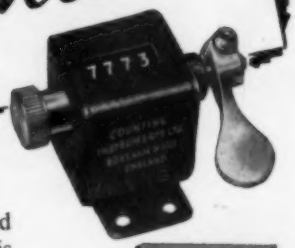

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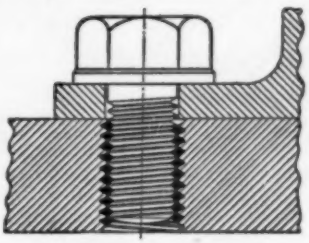

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Applications giving details of age, qualifications and experience, and quoting **D.O.18,** should be sent to

The Personnel Manager,
THE BRISTOL AEROPLANE COMPANY LIMITED
AIRCRAFT DIVISION
FILTON HOUSE, BRISTOL

PUBLIC APPOINTMENTS

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF SUPPLY

HIGH SPEED AERODYNAMICS LABORATORY
SALISBURY, SOUTH AUSTRALIA

Principal Scientific Officer
(one permanent and one temporary position)

SALARY: £1,688 to £1,874 per annum.

DUTIES:

POSITION No. 352: Responsible for experimental research, both basic and applied, into the aerodynamics of high-speed aircraft and missiles using the rocket-boosted free flight model technique.

POSITION No. 328: Responsible for experimental research, both basic and applied, into problems of supersonic flow, using wind tunnels, stock tubes and similar apparatus.

QUALIFICATIONS: University degree of high standard in science or engineering or equivalent qualifications, and extensive experience in aerodynamics research, especially in the transonic or supersonic fields. Experience in directing a team of research workers.

THE salaries quoted are Australian currency.

WHILST one position is temporary, the tenure of employment is not limited in this case.

WHERE permanent appointment is accepted, the successful candidate will be eligible to become a contributor to the Commonwealth superannuation scheme.

UNDER specified conditions, first class boat fare (if first class berth available) for the appointee and dependants (wife and dependent children) will be paid by the Commonwealth.

APPLICATIONS are invited for either or both positions.

THERE is difficulty in obtaining unfurnished accommodation in the Adelaide area, but the Department is prepared to help suitable applicants with this problem.

WHILE no definite assurances can be given, intending candidates should not let the housing problem deter them in making their initial applications.

APPLICATION forms obtainable from

SENIOR REPRESENTATIVE (A.P.15)
Department of Supply,
Australia House,
Strand,
London, W.C.2.

with whom applications must be lodged by June 4th, 1954. [2065

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APPLICANTS with experience on servo mechanism design in relation to problems of stability and controllability preferred.

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FURTHER information and application forms may be obtained from the

SENIOR REPRESENTATIVE (A.P.14),
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Department of Supply

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THE salaries quoted are Australian currency.

WHERE permanent appointment is accepted, the successful applicant will be eligible to become a contributor to the Commonwealth superannuation scheme.

UNDER specified conditions, first class boat fare (if first class berth available) of the appointee and his dependants (wife and dependent children) will be paid by the Commonwealth.

THERE is difficulty in obtaining unfurnished accommodation in the Adelaide area, but the Department is prepared to help suitable applicant with this problem.

WHILE no definite assurance can be given, intending candidates should not let the housing problem deter them in making their initial application.

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(3) Licensed radio engineers with category A endorsement.
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WRITE in first instance to Service Manager, Airwork General Trading Co., Ltd., Blackbushe Airport, Camberley, Surrey. With details of qualifications, etc. [2047

SENIOR draughtsmen with hydraulic experience required urgently.—Write, giving full information, to Personnel Manager, The de Havilland Aircraft Co., Ltd., Airspeed Division, Christchurch, Hants. [2069

SKYWAYS, Ltd., have vacancies for aircraft fitters and riggers at Stansted Airfield near Bishop's Stortford. Hostel accommodation available.—Write for application form to Personnel Manager. [2050

STARWAYS, Limited, have an immediate vacancy for a fully qualified Dakota captain. A.L.T.P. essential.—Apply, Liverpool Airport, Liverpool 19. [2052

JIG and tool draughtsmen for super-priority work. Good salaries and prospects. Pension scheme.—Full details to the Personnel Manager, the Fairey Aviation Co., Ltd., Hayes, Middlesex, quoting Reference PD/1. [1992

INSTRUMENT MECHANIC required, with or without "X" licence, experienced in aircraft maintenance and installation work.—Full particulars to Chief Clerk, The College of Aeronautics, Cranfield, Bletchley, Bucks. [2036

SERVICE engineers required for installation and trials of aeronautical and marine navigational equipment. Applicants must be of good appearance, prepared to travel in U.K. and have the following qualifications:

(a) Aeronautical: Under 35 years of age with electrical and radio theory to C. and G. Radio III standard.
(b) Marine: A.C. and D.C electrical theory to approximately O.N.C. standard. Knowledge of electronics or radar preferable.

GOOD conditions; expense and travelling allowances; pension scheme.—Apply, with full details including salary, quoting No. 1477 to Personnel Manager, Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middlesex. [1953

REQUIRED by The English Electric Co., Ltd., Aircraft Division, Warton Aerodrome, nr. Blackpool, stressmen with aircraft experience, to H.N.C. or degree standard.—Please reply, quoting Ref. 803G, to Dept. C.P.S., 336-7 Strand, W.C.2. [2055

E. K. COLE, Limited, Malmesbury Division, require a mechanical engineer of degree or Higher National Certificate standard for work on radar scanners and similar projects. Knowledge of aircraft stressing methods an advantage.

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JIG and tool draughtsman (senior) required. Good welfare facilities including staff pension scheme.—Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [0593

AIRCRAFT detail and assembly inspectors with recent experience required for large factory in Blackpool. Good pay and prospects for suitable men.—Apply, stating age and particulars of experience to Personnel Officer, Hawker Aircraft (Blackpool), Ltd., South Shore, Blackpool. [2023

DRAUGHTSMEN with sound experience of design, layout or detailing of aircraft structures required by Consulting Engineers for work on the South Coast (Bournemouth area). High salaries, pension scheme and excellent working conditions. Living expenses paid to men coming from away.—Box 5366. [2039

SENIOR and intermediate design draughtsmen urgently required, with experience on mechanical and precision engineering, for development work. Pleasant working conditions. 5-day week.—Apply, in writing, to Personnel Manager, Flight Refuelling, Ltd., Tarrant Rushton Airfield, Nr. Blandford, Dorset. [2043

ARMSTRONG SIDDELEY MOTORS require senior planning engineers for general machining work on gas turbine engines. Previous experience of gas turbines would be advantageous but not essential. Applicants with wide experience of general machining of other products would be considered.—Apply to Reference PE, Personnel Manager, Armstrong Siddeley Motors, Coventry. [1977

PILOTS required for maintenance testing duties. Applicants should have a wide experience of single and twin piston engined aircraft and jets. A Service instrument rating should preferably be held. An Indoctrination Course will be arranged for suitable applicants.—Write giving full particulars of experience, hours flown by types, etc., to Airwork Limited, Sutton Lane, Langley, Bucks. Envelopes to be marked "Flying Training." [2012

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SENIOR technical assistant required for wide variety of design problems on aircraft and guided missiles. Pleasant working conditions. Superannuation scheme after qualifying period.—Apply, Chief Designer, The Heston Aircraft Co., Ltd., Heston Airport, Hounslow, Middx. Tel.: Hayes 3844. [2006

SENIOR, intermediate and junior draughtsmen required for aircraft work of super priority. A.E.S.D. rates and upwards, depending on ability. Aircraft experience desirable but not essential. Apply, giving age and details of experience and salary required to Personnel Manager, Helliwells, Ltd., The Airport, Walsall. [1966

THE Supermarine Works of Vickers-Armstrongs, Ltd. require men with a degree, Higher National Certificate or an equivalent qualification for technical posts concerned with development flight testing of fighter aircraft. Experience of similar work would be an advantage.—Apply, in writing, to Personnel Department, Hursley Park, Nr. Winchester. [2061

SEVERAL senior draughtsmen with experience of turbine engine installations required immediately for both fixed and rotating wing installations. Good welfare facilities including staff pension scheme.—Applications, in writing, to the Personnel Manager, Hunting Percival Aircraft Limited, The Airport, Luton, Beds., stating age, experience and salary required. [2048

SENIOR draughtsman required with comprehensive experience of fuel and oil systems to initiate and take charge of section. Good welfare facilities including staff pension scheme.—Applications, in writing, to the Personnel Manager, Hunting Percival Aircraft Limited, The Airport, Luton, Beds., stating age, experience and salary required. [2049

TECHNICAL illustrators (male, senior) required. Considerable practical experience of illustrating for sales brochures and descriptive manuals essential. Good welfare facilities including staff pension scheme.—Applications, in writing, to Personnel Manager, Percival Aircraft, Ltd., Luton Airport, Beds, stating age, experience and salary required. [0592

H. M. HOBSON, Ltd., invite applications for positions in the drawing office as follows: designers, detail and modification draughtsmen, checkers, stressmen. The work is concerned with interesting projects connected with fuel metering equipment and hydraulic flying controls for aircraft.—Hobson Works, Fordhouses, Wolverhampton. [0420

HANDLEY PAGE (Reading), Ltd., The Aerodrome, Woodley, Reading, have vacancies in their design office for senior and intermediate draughtsmen and weightsmen. The work is on an interesting new project and there will be scope for rapid advancement to suitable applicants.—Please send full particulars of experience, etc., to the Personnel Officer. [0235

H. M. HOBSON, Ltd., Hobson Works, Fordhouses, Wolverhampton, require a number of technicians for interesting development work on power-operated flying control, hydraulic systems, and fuel metering systems. Preference will be given to applicants having previous experience of hydraulic systems, or to those of engineering degree or H.N.C. standard.—Apply, stating age, experience and salary required. [2029

DRAUGHTSMAN required for work on aircraft components. Experience in the aircraft industry desirable but not essential; good mechanical engineering draughtsman will be considered. Capable of working with the minimum of supervision. Write, giving particulars of age, experience and technical qualifications, to: King Aircraft Corporation, Fifth Street, Montrose Avenue, Hillington, Glasgow, S.W.2. [1933

METALLURGIST required with engineering background, experience in metallography and non-destructive testing of non ferrous and ferrous materials, essential. Good welfare facilities including staff pension scheme. Applications, in writing, to the Personnel Manager, Hunting Percival Aircraft Limited, The Airport, Luton, Beds, stating age, experience and salary required. [2010

DEVELOPMENT engineers capable of working individually on the development and assessment of Servo mechanisms, hydraulic actuators and general high-pressure system components. Applicants should possess an engineering degree or equivalent. Progressive appointments. Pension scheme.—Full details to Personnel Manager, The Fairey Aviation Co., Ltd., Hayes, Middlesex. Quoting reference H/1. [2011

D. NAPIER & SON, Ltd., Luton Airport, require engineers with technical standard approximating to ordinary National Certificate and with practical background to assist in the organisation and development of methods of production of the Napier De-Icing Surface Heater. Several posts with slightly differing requirements are open to men of about 30 years of age who should apply in writing initially with fullest possible particulars of experience to Dept. C.P.S., 336/7 Strand, W.C.2, quoting Ref. 1309. [2038

TEST engineers required as follows for interesting development work in connection with guided weapons: (a) senior engineers with degree or Higher National Certificate, for work on high-pressure sensitive hydraulic servos, previous experience desirable. (b) engineer, preferably with Higher National Certificate, for work on pneumatic or gas-operated components.—Applications should be made, stating qualifications and experience, to the Personnel Manager, British Messier Ltd., Cheltenham Road, Gloucester. Ref. BMCE/GO. [2054

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LOCKHEED HYDRAULIC BRAKE CO., Ltd., Leamington Spa, offers excellent opportunities to competent design draughtsmen with knowledge of aircraft power controls. Good salaries, attractive profit sharing and pension schemes.—Applications to Personnel Officer. [2044

D. NAPIER & SON, Ltd., require stressman for work on high speed aircraft with at least 5 years' experience on wing stressing. Much initiative is called for, backed up by academic qualifications of Higher National Certificate or higher standard. Post of responsibility with commensurate salary. Fullest possible particulars of experience necessary.—Reply, quoting Ref. 1307, to Dept. C.P.S., 336/7 Strand, W.C.2. [2035

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SENIOR and intermediate design draughtsmen, with good experience of aircraft or light structural or mechanical engineering, required for aircraft and armament project work.—Apply, by letter, to Portsmouth Aviation, Ltd., The Airport, Portsmouth. [0612

CHRISTCHURCH. Urgently required by The de Havilland Aircraft Co., Ltd., Airspeed Division, Christchurch, Hants, senior aircraft draughtsmen with air conditioning experience preferred.—Write, giving full particulars, to Personnel Manager. [2070

ARMSTRONG SIDDELEY MOTORS, Coventry, have vacancies for a number of designers and senior and junior draughtsmen. Although gas turbine experience is most advantageous it is not necessarily essential as training will be given in this specialized work to suitably qualified draughtsmen.—Apply, in detail, to Reference F.103, Personnel Manager, Armstrong Siddeley Motors, Coventry. [0200

AIRFRAME stressmen are required for a design office in the south of England and salaries of £800 to £1,000 per annum are offered to applicants with six to 10 years' experience, and to those with three to five years' experience, £13 to £15 per week.—Please send particulars of experience, qualifications and age, stating whether married, to Box AC88922, Samson Clarks, 57-61 Mortimer Street, W.1. [0236

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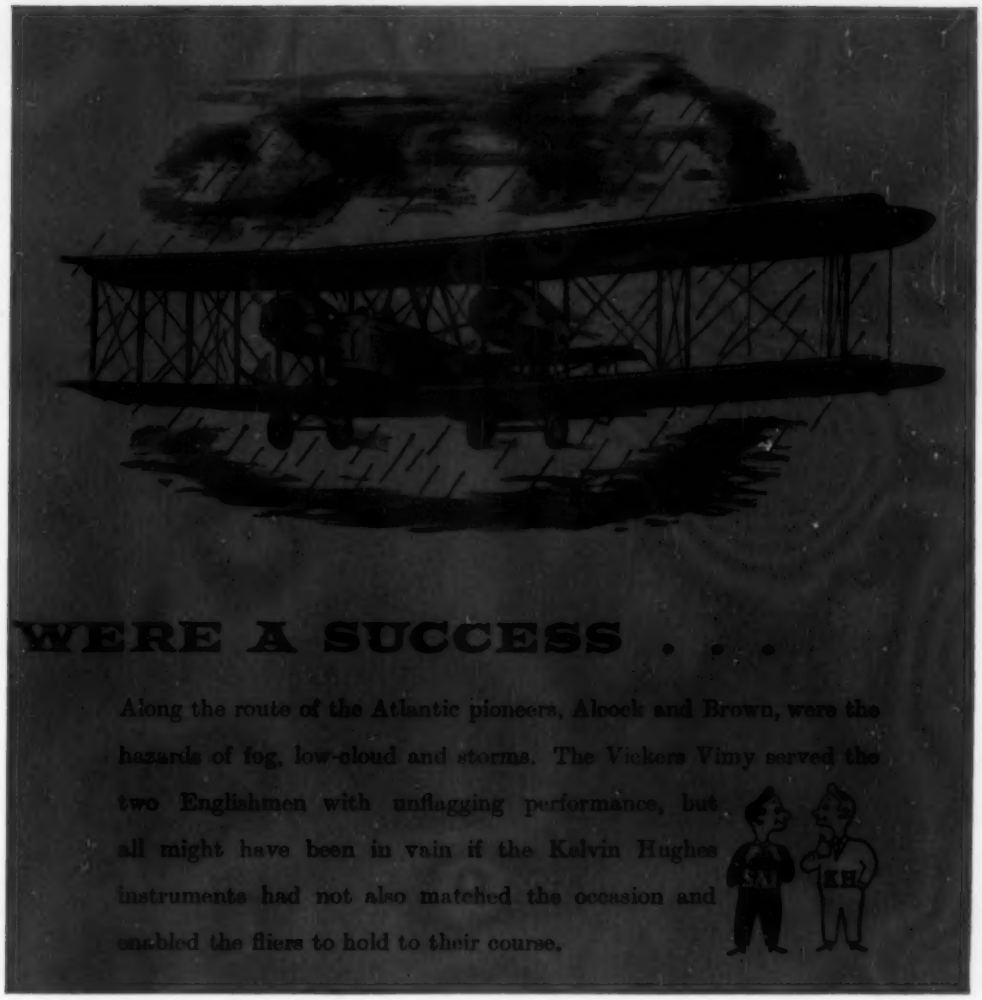

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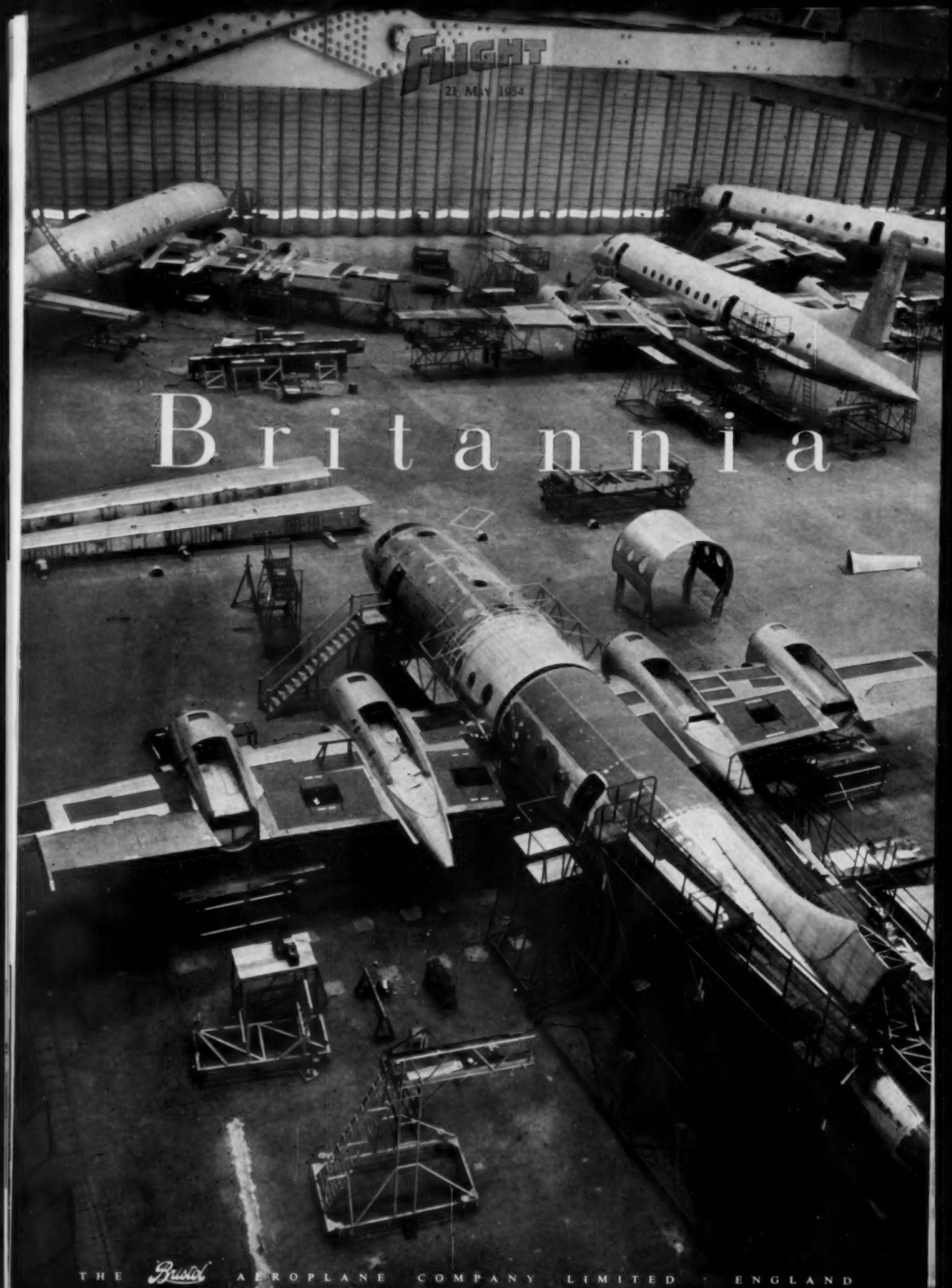

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